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THE GIFTED PUPIL IN THE AMERICAN HIGH SCHOOL

CALIFORNIA TEACHER VIEWS ENGLISH SCHOOLS

CURRENT EVENTS AND MATERIALS IN HOMEMAKING EDUCATION

A SYMPOSIUM ON
MODERNIZING SECONDARY SCHOOL MATHEMATICS

Next Month a Symposium on
TOWARD EXCELLENCE IN HIGH SCHOOL SCIENCE

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A SYMPOSIUM NEXT MONTH ON
TOWARD EXCELLENCE IN
HIGH SCHOOL SCIENCE

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EDITORIAL

AMERICAN EDUCATION: ACCENT ON QUANTITY

A discussion of the quantitative-qualitative problem in American education is timely this month when the *Journal* presents a symposium on mathematics, a quantitative discipline.

Americans are often criticized by foreigners for their undue concern with bigness. They are accused of behaving abroad like Texans, always bragging about how big things are at home. Unquestionably we like to do things in a "big way" and, unfortunately, to talk too much about it. Admittedly there is a bigness about this country which does not confine itself to the wide open spaces of the prairies and to the majestic mountains, but which permeates our total way of life—the highways we build, the size of the automobiles we mass produce, our large mechanized factories and farms, a nationwide system of chain stores, giant corporations, and yes, even the size of our schools. Bigness pervades every facet of American life. Strange indeed would it be if this characteristic were not expressed in our educational system. During the course of the nineteenth and first half of the twentieth century we developed the most ambitious educational system in the world. Nowhere had such a large, all-inclusive plan of public education been attempted. We aimed to enroll in school everyone from the ages of six to sixteen, and have largely succeeded; a substantial majority remain another year or two to graduate from high school, and half of those who do so now go on to college. In addition, adult education, rapidly becoming a major segment of American education, is the fastest growing of all.

In the current educational debate, the point repeatedly made is that America has been cursed with bigness, preoccupied with quantity of education rather than with quality which has consequently suffered. The further point advanced is that we should now turn attention more to qual-

ity, perhaps even to cut back numbers, and try not to do so much for so many. The logic is that with X amount of energy to expend, the quality of the finished products will be better if that energy is concentrated on fewer of them. The educational argument appears to be that in giving attention to such large numbers each person receives a more mediocre education than when only a few are included. Largeness and mass production are equated with lower standards and mediocrity, in comparison with systems which educate only a selected minority. These partial truths are just plausible enough to mislead. This line of argument which equates large numbers with poor quality does not square with the facts. Examples to prove the contrary abound, both within the field of education and outside.

Mass production has made more widely available many products (e.g., automobiles, radios, household goods, clothing, and housing) of high quality and functional design at lower unit cost than did a productive system based on handcraft work which lavished great care and energy upon the fashioning of a few finished products.

Frequently not until large numbers of a product are to be manufactured can enough be spent to assure the requisite high degree of skill in planning and designing to ensure a superior product. A skilled industrial designer, such as Raymond F. Loewy, will spend days with a full staff in planning the design of a functional filling station which when completed will be duplicated thousands of times. The result, qualitatively, is better than when only a few stations are produced, for then mediocre, poor, or no designers at all are called in.

Similarly, examples in education spring to mind. A lecture prepared for a class of thirty pupils, then repeated five or six times in a day to other classes of thirty, this process duplicated day after day, is likely to be less effective than a lecture prepared and delivered to a group of 150 to 180 pupils, especially when the extra time saved by lecturing only once is spent in more thorough preparation. Still the idea persists that a class of thirty is always better than a class of 180 purely because it is smaller.

American schools are on the whole bigger in size than European ones. Seldom does a European secondary school approach the size of a typical metropolitan high school in the United States. In developing multilateral or comprehensive schools in place of single purpose ones, Europeans are concerned lest the necessary diversification of courses will require schools too large in size. The English headmaster feels uncomfortable if his school is so large that he cannot, in one manner or another, know every pupil by name. In this country we believe, and not without evidence, that a small school is not likely to be as good as one that is large enough to provide a rich curricular offering. The distinguished James B. Conant stated recently in a nationwide television broadcast that the greatest single ob-

stacle to good high school education in this country was the excessive number of small high schools. At the other end of the scale, we appear to be veering away from having high schools become too large, the number of high schools of 5,000 and over having decreased in the last decade. However, some recent studies on school size suggest little evidence that, in the middle range, schools of 2,000 or 3,000 are any better or poorer because of size *per se* than are high schools of 1,000 or 1,500.

A clear example where size, scope, and quantity have led directly to improved quality is in textbooks. American textbooks are sought the world over. Beautifully printed, illustrated, organized, and written, they are in themselves a potent force for a higher quality of instruction, especially when superior teaching talent is in short supply. Without detracting from the credit due the distinguished publishing companies in this country, the large, highly competitive market for textbooks, a direct result of mass education, has made possible the care necessary to produce books of such high quality. Here, clearly quantity has contributed to quality.

It is fallacious to assume that because we have tried to do so much educationally for so many the quality of that schooling must necessarily be poor or below that of countries which have a much more restricted program. For quite the reverse may be the case. As has been pointed out repeatedly in the recent public discussion of this problem, a fair comparison is of the 5 to 10 per cent of honor students in this country with the total enrollment in the selective European secondary school. For an excellent discussion of this point see the statement by B. S. Hollinshead, "Is European Education Better?" in the April 1958 issue of *The Educational Record.*

True, that as the number of pupils increases, so will the range and diversity of their abilities and talents be greater. Common standards or requirements no longer will be possible or desirable. To require that a talented young musician, athlete, mathematician, and painter follow exactly the same curriculum, attain the same standards in only a limited range of academic subjects or be eliminated from further education does not mean that the quality of education remains high, but rather that talent may be wasted.

In this country the emphasis has been to open wide the doors of educational opportunity, encouraging large numbers to attend school for as long as possible, quite the opposite of the European tradition. The accent upon numbers has enabled us to raise the whole level of American life, quantitatively and qualitatively. That the production and consumption of serious music in this country is flourishing as nowhere in the world is not unrelated to the fact that music has for a long time been a basic part of the general education of elementary and increasingly of secondary school pupils on a mass basis and that big media of communications

(quantity again) have brought good music in increasing quantity and frequency to Americans, young and old.

There is no quarrel with the proposition that in having gotten everyone into school (a quantity problem) attention should now increasingly be turned to the quality of the educational experience provided. We do protest the assumption that bigness means badness, that where numbers are large, quality must necessarily be poor. The Mayo Clinic and the University of California, both the largest of their kind in the world, also rank at the summit in quality. We protest the line of reasoning which suggests that small, selective and restrictive situations are always to be preferred, that they are always of higher quality. Such an aristocratic, class-oriented line of thought is both fallacious and sinister.

The American accent on quantity in education may, in the long run, prove to be the dominant factor in providing also a way of life characterized by quality.

R. N. B.

EDITORIAL BOARD CHANGES

T. STANLEY WARBURTON RENDERS DISTINGUISHED SERVICE

For the first time in many years the name of T. Stanley Warburton, Superintendent, Fullerton Union High School and Junior College does not appear on the masthead of the *Journal*. He was active from the beginning of the California Society of Secondary Education which founded the *Journal*. He was instrumental in bringing about its merger with the California Association of Secondary School Administrators. He has, since that merger in 1952, served during the critical transition years as chairman of the Editorial Board. At his own insistence, his retirement from the Board has been regretfully accepted. We here recognize and express gratitude for the distinguished service he has rendered to the *Journal* and to the whole field of secondary education. Happily, his active leadership continues. This year he serves as president of the California Association of Junior Colleges.

Dr. Earl P. Andreen, principal, Lincoln High School, San Diego succeeds Dr. Warburton as chairman of the Editorial Board and Dr. Norman B. Scharer, Superintendent, Santa Barbara City Schools, comes onto the Board to fill the vacancy created by Dr. Warburton's retirement.

THE GIFTED STUDENT IN THE AMERICAN HIGH SCHOOL

BY PAUL WITTY*

Since Sputnik I an intensified interest has appeared in the education of the gifted and "academically talented" high school student. This emphasis is relatively new; in fact, it was only about a decade ago that Catherine Cox Miles commented as follows concerning the treatment accorded such secondary school students:

> "The gifted, the potential leaders, discoverers, and creators, however, are usually left to develop their own skills in their own way, and in terms of personal initiative alone."[1]

Impetus was given to the development of more challenging curriculums by the sudden awakening of many people to the fact that the typical high school curriculum often failed to interest or stimulate gifted pupils. This fact was disclosed by several analyses prompted by comparison of offerings in American high schools with those of other countries.

Today's interest in the superior student is traceable also to the recent spread of knowledge concerning gifted children and youth. *The American Association for Gifted Children,* recognizing the need for the dissemination of facts relating to the nature and needs of the gifted, prepared a book entitled *The Gifted Child,* which was published in 1951. This book was widely read and helped to rekindle interest in the education of the gifted. Chapters in the book presented data from genetic studies, and gave

* Professor of Education, Northwestern University. This article is based upon his Cubberley Lecture, Stanford University, July 9, 1958, which was given in connection with the Conference on New Directions for the American High School.

[1] Catherine Cox Miles, "Gifted Children," *Manual of Child Psychology,* L. Carmichael, editor. New York: John Wiley and Sons, Inc., 1946, p. 931.

an overview of the nature and extent of educational offerings available to the superior student. In the final chapter it was pointed out that the United States might not produce her quota of leaders in science and other fields unless home and school cooperated effectively to foster the full development of capable students through more adequate guidance and more stimulating educational experience. A few years later, in what is probably his last written comment on this problem, L. M. Terman stated:

> "Failure to make the most of our intellectual resources has been thoroughly documented by several recent researches, especially by those of Wolfle and the National Manpower Council. Wolfle estimates that 41 per cent of our youths who rate in the top 1 per cent for tested ability either do not enter college or, if they enter, do not remain to graduate. He further estimates that of those who have the intelligence to earn a Ph.D., less than 2 per cent do so. Of my large group of gifted children with IQ's of 140 or higher who were located in California thirty-five years ago, 15 per cent did not enter college and 30 per cent did not graduate. Though all of these presumably had the ability to earn a Ph.D., M.D., or their equivalent, only 15 per cent of the men and 5 per cent of the women did so [pp. 15–16]."[2]

It is noteworthy, too, that Terman stressed the significance of a broad perspective in dealing with various types of gifted students. Even before the appearance of Sputnik I, he cited the danger of paying too much attention to the development of scientists with a neglect of necessary leaders of other types.

Harry Passow too has commented in a similar vein:

> "The daily press and professional journals alike are clamoring about shortages of scientists and engineers. . . . Perhaps our most frightening shortages are not in the general supply of scientists but in those rare persons with imagination, creativity, motivation, competence, and education who can contribute something fresh and basic to our understanding of man's relations with man."[3]

Better Programs for the Academically Talented

One result of the current emphasis on the role of superiority is found in increased attention to the needs of the college-bound high school student. A conference was called in Washington on Saturday, February 8, 1958, to discuss the problem. James B. Conant, who served as chairman,

[2] L. M. Terman in Chapter I of *Education for the Gifted,* (R. Havighurst, Chairman) *57th Yearbook* of the National Society for the Study of Education, Part II, Chicago: University of Chicago Press, 1958.

[3] Harry Passow, quoted in *Education Digest,* March 1957.

made these recommendations in a report which appeared in *School and Society*, May 10, 1958.

> ". . . Throughout the conference, we used the phrase 'academically talented' to refer to that 15 to 20 per cent of an age group who have the ability to study—effectively and rewardingly—advanced mathematics, foreign language, physics and chemistry. Obviously the gifted would be included in this broader definition.
>
> ". . . It was taken for granted that the academically talented would be educated in the same secondary school as others less talented. The assumption was that such a general high school can offer a good educational program to a wide variety of pupils who benefit from the social experience of participating in a common enterprise with pupils of different backgrounds and abilities."[4]

It was recommended that a comprehensive program be initiated in the high school for the academically talented student. This program would include: (a) four years of the study of English, (b) four years of one modern language, (c) one year of physical science and one of a biological science, and (d) one year of American history, one year of history other than American, and one additional year of some other aspect of social science.

This recommendation seems particularly fitting today. The need for more comprehensive programs at this level has been emphasized again and again in studies of bright pupils made in the twenties and thirties. And it has been disclosed vividly by more recent studies showing the meager opportunities offered gifted students in many high schools. The lack of challenge to use their ability is undoubtedly one reason for the failure of many capable students to go to college. Lack of challenge may also lead others to drop out.

Reactions of pupils themselves also confirm the need for improved educational opportunities in the high school. For example, in our studies of "graduates" of the Quiz Kids program, we sent inquiries to extraordinary pupils who had appeared several times on this program. These young people overwhelmingly stressed the uninteresting, unchallenging nature of much of their work in the high school. They indicated that teachers, burdened with large classes, are usually unprepared or are unable to provide suitable, stimulating work. They recognized the fact that gifted pupils are sometimes given double promotions and are sometimes assigned routine responsibilities within the classroom. Some of these "graduates" pointed to advantages in the prudent use of acceleration. They stressed the fact that little incentive or stimulation is offered the capable pupil

[4] James B. Conant, *School and Society*, May 10, 1958.

who sits through course after course accumulating the credits that lead to graduation.[5]

Another recent study adds corroborative testimony to this report. Paul Dressel and John Grabow directed inquiries to the gifted students who were graduates of high schools in Dearborn, East Lansing, Grosse Pointe, Highland Park, and Lansing, Michigan. Criteria for giftedness varied and included such statements as "all and only those in the top five per cent, as determined by scholarship record of the five most recent classes." Five hundred and two responses related to various aspects of the students' high school experience and to their attitudes toward extracurricular activities.

It was found that "classes and courses, on the whole, provided neither the stimulus nor the involvement to challenge these students."

It was surprising that "only the extra-class activity really provided the challenge and satisfaction needed to make high school a pleasurable experience," according to the report of many students.

The problem of stimulating and motivating the superior student is one that deserves more penetrating research. A study by Charles C. Cole has yielded some very provocative findings on this topic. Cole reports questionnaire responses from 32,750 seniors, considered a random sample of students in public high schools. These students also took a brief academic aptitude test. The pupils who were in the upper 30 per cent on the aptitude test (9,689 seniors) replied to questions about their intent to go on to college or their reasons for not planning to attend college.

Twelve per cent of the high scoring group indicated that the most important reason for not planning to go to college was financial need. Many others stated that financial need was an important consideration, but the importance of "lack of college goal" was also indicated many times.

> ". . . About 25 per cent of the high scoring boys and 45 per cent of the girls cited the lack of a college goal as possibly an important reason for not continuing their education. This suggests that there is considerable validity in believing that, despite the importance of financial need, lack of motivation for college is a stronger deterrent to college going among those of high ability who do not go on to college."[6]

Certainly it appears that the ideal of self and the goal a pupil sets for himself are important factors in his realization of adult attainment commensurate with his youthful promise. How and when such goals arise are challenging, little-studied problems. There are, however, some studies

[5] Paul Witty, "A Study of Graduates of the Quiz Kids Program." *Educational Administration and Supervision*, May 1952.

[6] Charles C. Cole, "Current Loss of Talent from High School to College, Summary of a Report." *Higher Education*, March 1955.

which have yielded valuable clues on this perplexing topic. We have already indicated the significance of challenging school curriculums. In addition, comparative studies of young adults who were identified as gifted children have yielded provocative data. For example, Terman divided his group of gifted young men into groups, according to a comprehensive criterion—the most successful and the least successful. The parents of the most successful group were superior in education, vocational status, and cultural background. Case studies have also revealed the importance of early home and school guidance in determining the goals which gifted students seek. No less important is the acquisition of early attitudes which affect favorably their mental health and stability.[7]

Need for Greater Challenge

It is generally conceded that there is a great need for more suitable curriculums within the comprehensive high school. Such provision would aid greatly the college-bound student and would undoubtedly give greater stimulation to the gifted student.

We must not assume that the problem of educating the potentially gifted student is so simple as to be solved merely by improving the high school curriculum so as to offer greater challenge for the college-bound student. The effort must be coupled with more imagination, creative endeavor. And such accomplishment is possible to offer within the comprehensive high school broadly conceived and developed to care for the full range of individual differences and needs.

James B. Conant has pointed out that many present-day high schools are to a degree fulfilling this need. But he indicates that schools of this type are found usually in privileged communities and heavily populated areas. Acute needs are found in small schools located in rural and semi-rural districts and in schools having very meager funds and support.

Ford Foundation Programs to Challenge the Gifted

To foster the development of superior pupils, the Ford Foundation has sponsored programs to bridge the gap between high school and college. In a sense these programs involve acceleration.[8] Recently there has developed an increased interest in, and more widespread use of, acceleration in the high school. For example, in 1951 the Fund for the Advancement of Education (established by the Ford Foundation) initiated and

[7] Paul Witty and Anne Coomer, "A Case Study of Gifted Twin Boys," *Exceptional Children*, December 1955.

[8] Fund for the Advancement of Education. *Bridging the Gap Between High School and College*, Evaluation Report No. I. New York: Ford Fund for the Advancement of Education, June 1953, and *They Went to College Early*, Evaluation Report No. 2, New York: Ford Fund for the Advancement of Education, 1957.

financed an experiment involving superior high school students. Under the Early Admission Program, 420 boys and girls, most of them sixteen or under, who had completed at least the tenth grade and seemed "ready, both academically and in terms of personal maturity, to enter college" were given Ford scholarships to any one of eleven participating colleges. This Fund-financed experiment, which ended in 1956, made a real breakthrough, at least on the college front, in the education of the superior student. Increasingly colleges are now making early admissions a part of their policy. The young scholars demonstrated to the skeptics that a gifted student can skip a year or even two years of high school and still adjust socially, emotionally, and academically to college life.

Another form of acceleration which is gaining supporters is the speed-up program. In some schools students or a whole class may be encouraged to do the work of several grades in less time. For example, in Baltimore a pupil of high ability may complete the three years of junior high school in two years. In senior high school he may take a year of college-level work and thus qualify for admission to college as a sophomore. This plan has been followed for some fifty years. Graduates have been admitted to the sophomore classes of colleges such as Cornell, Goucher, Oberlin, and Smith.

Another plan of the Ford Foundation involves the provision of college-level work in high schools. This experimental program of the Fund for the Advancement of Education—the Advanced Standing Program—is now sponsored by the College Entrance Examination Board. The Board provides high schools with descriptions of college courses in twelve fields and prepares examinations in them. Students who pass the examinations may apply for college credit. Students thus admitted with advanced standing can complete college in less time, or they can take more advanced work or venture into fields they might otherwise not have time to explore. In 1953–54, the first year of the program, eighteen secondary schools and 532 students participated. Last year, according to the Fund, 1,229 students from 110 schools entered 138 colleges.

The results of these programs have thus far proved rewarding. Elbert Fretwell has discussed some of the results. Not only are these students successful in their college work, but they are rather well-adjusted and socially effective. Moreover, college teachers and administrators report that these students are assuming leadership in school activities and are causing instructors to raise their standards and goals.[9]

This program faces several obstacles. For one thing, some high schools are not equipped to offer effective college-level work. Because of the

[9] Elbert Fretwell, "Challenge of the Gifted," *Journal of Higher Education*, June 1957.

shortage of adequately trained teachers, this problem is great. In addition, some colleges are reluctant to admit that high schools can offer worthwhile college courses. And some sincere administrators and teachers believe that more profitable and individually appropriate experience can be provided for gifted youth within the high school.

The Complexity of the Problem of Educating the Gifted

The foregoing efforts, including more adequate provision for the "academically talented" as well as the use of acceleration in various forms, will serve in meeting the needs of many superior students and promising scholars. But will such provisions satisfy the needs of "gifted" students, particularly when a broad criterion of "giftedness" is employed?

A most heartening accompaniment to the emphasis on the education of the "academically talented" is to be found in the current interests in a broader concept of gifts and talents. Havighurst states:

> ". . . The talented or gifted child is one who shows consistently remarkable performance in any worthwhile line of endeavor. Thus we shall include not only the intellectually gifted but also those who show promise in music, the graphic arts, creative writing, dramatics, mechanical skills, and social leadership. Although most of the attention of educators has been directed toward the intellectually gifted . . . we think of such special attention to the intellectually gifted as a weakness or shortcoming in the kind of program for gifted children that we should like to see in existence."[10]

The adoption of a broad criterion of "giftedness" should not lead one to minimize the significance of attempts to provide more adequately for children who are gifted in abstract intelligence. These children form one important type of gifted children. They have other special gifts too. But there are many other pupils whose gifts cannot be identified through the use of intelligence tests, since the relationships between IQ obtained from tests and ability in areas such as art, creative writing, and music are low. This is true, too, of the relationships between abstract intelligence and mechanical ability and social leadership.

A few projects in behalf of the gifted recognize these facts. One project

[10] Robert Havighurst, *57th Yearbook, Part II,* National Society for the Study of Education, Chicago: University of Chicago Press, 1958. See also Robert Havighurst, Eugene Stivers, and Robert F. DeHaan, *A Survey of the Education of Gifted Children.* Supplementary Educational Monograph, No. 83. Chicago: University of Chicago Press, November 1955, p. 8. See also Chapters I and III of the 57th Yearbook, Part II, *Education for the Gifted.*

cooperatively undertaken by the Reed College faculty and the Portland school officials includes not only

> "the intellectually gifted and academically skilful but also those with high capacity in art, music, dramatics, dancing, creative writing, mechanical skill and comprehension, and social leadership. Moreover, the Reed faculty advisers to the project and the co-operating public school teachers have concentrated attention on personality characteristics such as drive, self-direction, creativity, curiosity, and some sixteen more. Students who rate high on these are identified as gifted, even though their scores on intelligence tests are ordinary. When identified and grouped by fields, these high school students are given seminars, many of them participated in by Reed instructors."[11]

Another notable recognition of the fact that high abstract intelligence is only one factor in the identification of the potentially gifted student is found in the work of Paul Brandwein. In his brilliant book, *The Gifted Student as Future Scientist,* some valuable suggestions on identification are found:

> "Three factors are considered as significant in the development of future scientists: a Genetic Factor, with a primary base in heredity (general intelligence, numerical ability and verbal ability); a Predisposing Factor, with a primary base in functions which are psychological in nature; an Activating Factor with a primary base in the opportunities offered in school and in the special skills of the teacher. High intelligence alone does not make a youngster a scientist."[12]

Other studies confirm these observations and suggest that potentially gifted pupils in the area of science are typically characterized by high verbal ability, high mathematical ability, and superiority in various aspects of science which may be revealed on tests. But they are characterized also by "drive" or determination to use their abilities, as well as by a searching, inquiring attitude and a strong interest in science.

Some of these abilities are nurtured in a classroom in which a capable teacher offers pupils motivation and varied opportunities for development. In this connection a very serious problem arises because of the shortage of well-trained teachers.

[11] Malcolm S. McLean and Robert B. Carlson, "College and University Programs for the Gifted," *Education for the Gifted,* the 57th Yearbook of the National Society for the Study of Education, Part II, edited by Nelson B. Henry, Chapter XIII, p. 325.

[12] Paul Brandwein, *The Gifted Student as Future Scientist,* New York: Harcourt, Brace and Co., Inc., 1955, p. xi. See also *57th Yearbook,* Part II, National Society for the Study of Education, Chicago: University of Chicago Press, 1958, Chapter XII.

Techniques for the Identification of Gifted Students

There are admittedly few valuable and reliable measures existing to judge art ability and appreciation. Consequently we must depend to a considerable degree upon subjective judgment to identify artistically talented youth.

> "Judgment of talent, of course, cannot be made lightly or hastily. The teacher who believes a pupil possesses unusual artistic talent might be wise to enlist from time to time the opinions of some others, including artists and art teachers. Opinions of these well-informed people, furthermore, might well be sought over a relatively long period of time. What at first appears to be talent may later prove to be merely a remarkable, but temporary, development of skill. What might be artistic talent in early years may disappear as the child develops divergent interests which channel his energies and abilities into other directions.[13]

However, several interesting and seemingly effective techniques are being used to detect consistently remarkable performance in the arts. In one experiment, the symbolic and imaginative film by the distinguished cameraman, Arne Sucksdorff, ***The Hunter in the Forest***, was shown in seventy-nine classrooms in forty schools located in thirty-four cities.[14] All grades were represented. The eight-minute motion picture is presented without narration or dialogue. It has a musical score with sound effects to accompany the appearance of birds and animals.

At the beginning of the picture, the subtitle "A Story Without Words" provides an introduction to the pupils who are invited to write their own stories about the film. A film guide, developed for teachers, suggests related language experiences and some steps to be followed in eliciting genuine expression from children.

Over two thousand compositions composed by children after viewing the film were judged according to the degree to which the writing reflected (a) genuine feeling; (b) sensitivity to the value of particular words, phrases, and larger units in expressing their reactions; (c) recognition of the film maker's intent and the significance of symbolic presentations; and (d) correct and appropriate use of English. About 10 per cent of the total number of compositions were judged to be outstanding and to suggest potential ability on the part of the writers.

[13] *57th Yearbook*, National Society for the Study of Education, Part II, chapter by Lloyd Michael, p. 301.

[14] Paul Witty, "The Use of Films in Stimulating Creative Expression and in Identifying Talented Pupils," *Elementary English*, October 1956. Paul Witty and William Martin, "An Analysis of Children's Compositions Written in Response to a Film," *Elementary English*, March 1957.

There are, of course, other approaches to the identification of gifts in fields such as art and music.[15] Jack Kough and Robert DeHaan have suggested criteria for the location of such pupils as well as classroom activities to foster expression in each area. Suggestions are also given for the identification and encouragement of children gifted in social leadership and other areas.[16] But the complexity of the problem must be recognized. As John Hersey states:

> "It is time to restore perspective to our views on help for the gifted. Educational practice is a set of slow pendulums. Just now the gifted child is in fashion—and in a little danger, too. School systems all over the country, sensitive to fierce pressure from our society for technicians and experts of every kind, are rushing headlong into programs to produce highly efficient, useful, skilled, dependable, ready-made cogs for a scientific economy. . . .
>
> "But the job of freeing talent does not lend itself to this kind of attack. Talent is elusive, fragile, manifold, fast-moving, luminous, tantalizing, and incredibly beautiful, like aurora borealis on a cool September night. Who would give a weatherman a bag of money and tell him to go out and catch some northern lights? . . .
>
> "The perspective that is needed is this: Our uncertainty about exactly how to develop talent is only one part of the greatest unsolved problem in American education—the problem of how to help every child realize his maximum potential; the problem . . . of individual differences."[17]

The Importance of Mental Health

One of the greatest obstacles to the full utilization of ability is traceable to problems of mental health which curtail or block the expression of ability. This source of waste may be reduced by intelligent cooperation between the school and the home. Certainly our discussion of the gifted has demonstrated the fact that they need early and continuous guidance. But studies show that present school practices are woefully inadequate in offering satisfactory guidance and counsel for them.

Gifted students, similar to all others, will from time to time need individual help to meet personal problems as they arise. Symptoms of in-

[15] Jack Kough and Robert DeHaan, *Teacher's Guidance Handbook* (Vol. I), *Identifying Children Who Need Help.* Chicago: Science Research Associates (Elementary Edition), 1955.

[16] Jack Kough and Robert DeHaan, *Teacher's Guidance Handbook* (Vol. II), *Helping Children with Special Needs.* Chicago: Science Research Associates, 1956.

[17] John Hersey, *57th Yearbook, Part II,* National Society for the Study of Education, pp. 4 and 5. Chicago: University of Chicago Press, 1958.

stability among the gifted appear to be fewer than among students generally. But there are some problems that will be conspicuous or at least frequent in this group. Among these problems are feelings of inferiority, disappointments traceable to lack of agreeable companionship, home and parental obstacles, and various forms of frustration or anxiety.

Feelings of inferiority are sometimes traceable to physical factors. One reason, of course, is that the gifted pupil is very quick in performing feats involving mental ability, and he is relatively much slower in developing physical skills. One writer reports that highly gifted adolescents were found to be "below average" in participation in extracurricular activities. Moreover, their efforts to relate themselves to the activities of adults often were thought to be inadequate or futile.

Another problem in which the gifted adolescent frequently needs help relates to satisfactory outlets for his talents. Although some gifted youth do experience satisfactory expression of their talents, many others fail to do so.

It is inevitable then that another source of difficulty would be met as the highly gifted person attempts to work out an appropriate set of values and aspirations. This quest is especially difficult in terms of the pressures and demands of some parents and families.

> ". . . These families, predominantly upper middle class, exhibit all the drives for advancement of their social status and for competitive success that Warner has found characteristic of the upper middle class as a whole. Of superior intelligence, they hold high standards for themselves, and high expectations for their children. At the same time they reveal more awareness of the disparity between what life might be and what it is, more frustration in themselves, and more apprehension for their children."[18]

> ". . . The need to work through and resolve these inconsistencies and conflicts is one of the major sources of adolescent stress in America.
>
> "The higher the adolescent's intelligence the more insistent is this need. At the same time, the higher the intelligence the more difficult the problem."[19]

It is apparent that the gifted pupil needs skillful guidance if his talents are to be detected, directed, and encouraged. Moreover, he will need expert help from time to time in meeting problems in adjustment and in

[18] *The Gifted Child, op. cit.*, p. 100. See also W. Lloyd Warner, Marcia Meeker, and Kenneth Eells, *Social Class in America*, Chicago: Science Research Associates, Inc., 1949.

[19] *The Gifted Child, op. cit.*, p. 103.

developing an ideal of self. Greatly expanded guidance services will be required in the comprehensive high school if these goals are to be achieved to an appreciable extent.

The Significance of the Teacher

Wherever we find that outstanding provisions are being made for the gifted pupil, we discover evidence of the far-reaching effects of capable, conscientious, and devoted teachers. Techniques of themselves are apparently secondary to the interest, enthusiasm, and general competence of the persons directing the programs.[20]

Of course, these teachers emphasize the importance of encouraging and challenging the gifted pupil to work in accord with his ability, and a variety of instructional devices are employed to attain this goal. In these classes more intensive assignments yield extra credit; abundant opportunity is given for class participation; facilities are made available for individual projects; wide use is made of supplementary reading materials; varied textbooks are employed; and individual assistance and counseling are given generously. Extensive use is frequently made of community resources, pupils are encouraged to participate in club programs and in contests, and planning of class activities is often engaged in cooperatively by the pupils and their teachers. These practices challenge the superior student and lead him to apply and develop his ability in many rewarding ways.

Concluding Statement

We have reviewed some of the outstanding recent efforts to provide more adequate educational opportunities, motivation, and challenge for gifted students in the American high school. Heartening indeed are proposals for extending and enriching the curriculum in the comprehensive high school in behalf of the "academically talented." Encouraging also are the numerous attempts to develop more suitable curricula and to "bridge the gap" between high school and college so that the capable student will not repeat work. Perhaps the most promising trend is found in the growing acceptance of a broader criterion of giftedness than that indicated simply by a high intelligence test rating. According to this definition, students are considered potentially gifted if their performance in various worthwhile types of human endeavor is consistently or repeatedly remarkable. Commendable indeed are the efforts to develop high school and college offerings including seminars designed to give perspective and challenge to such students. Of course, these efforts constitute merely a beginning in a great movement. But their significance should nonetheless

[20] Paul Witty and Samuel Bloom, "Conserving Ability in the Sciences," *Exceptional Children*, October 1955.

be recognized. They stand as a noteworthy accomplishment and serve also as a beacon to others. In looking with hope and confidence to the future, we can find no more appropriate and insightful comment on the education of the gifted than that written by L. M. Terman for the *57th Yearbook of the National Society for the Study of Education*:

> "Preparation for the greatest possible service to society might seem a valid criterion of what education for the gifted should accomplish. However, history tells us that what passes as a service to society varies with the *Zeitgeist*—the ever changing spirit of the times. . . .
>
> "The current *Zeitgeist*, under the influence of the cold war, is pointing up the need for many more scientists and engineers than we have, with the result that a desperate effort is being made to increase their number. Granted the great need for such increase, that fact should not lead to the neglect of other kinds of talent. What I propose is that education of the gifted should be planned not merely to satisfy the felt needs of a given time but also to prepare the way for future appreciation of needs not yet recognized. By encouraging the development of all kinds of special talent and of aptitude for every kind of leadership and scholarly achievement, the *Zeitgeist* itself would, in time, be molded along more liberal lines and to the appreciation of whatever enlarges the spirit of men."[21]

[21] L. M. Terman in Chapter I of *Education for the Gifted*, Part II, *op. cit.*, p. 17.

TO PERSONS INTERESTED IN SOCIAL STUDIES AND SOCIAL SCIENCES:

The Thirty-eighth Annual Convention of the National Council for the Social Studies is to be held in San Francisco at the Sheraton-Palace Hotel on November 27–29. This is the first visit of the National Council for the Social Studies to the West Coast and another nationwide convention sponsored by this organization is not likely to be held on the West Coast for some time to come.

Every social studies teacher is invited to attend and participate in the convention. Those who wish to purchase a national membership and receive the journal of the National Council for the Social Studies, titled *Social Education*, plus the Yearbook, may do so by sending $7.00 to the national headquarters at 1201 16th Street, N.W., Washington 6, D.C., or by joining at the convention in San Francisco. Those who wish merely to attend the convention may do so by paying a $2.00 registration fee at the time of registration.

AN AMERICAN TEACHER LOOKS AT ENGLISH SCHOOLS

BY GORDON L. MCANDREW*

One of the valuable experiences in visiting a foreign country is its help in eliminating mistaken notions. I recall my amusement at how surprised—and perhaps disappointed—one of my English friends was to discover that cowboys are not a common sight on the main streets of our western cities. Perhaps I was just as surprised—although I am sure not disappointed—not to find, on my first visit to an English school, David Copperfield trying to do arithmetic under the tyrannical eye of Mr. Murdstone. The American West has come a long way since the days of the cowboys and Indians, and Charles Dickens, after all, wrote some time ago.

My "look" then at English schools helped correct some of my mistaken ideas. In arranging visits I tried to schedule as many different kinds of schools as possible. My observations are based on these visits as they helped me understand the nature of English education and the problems it faces.

The Role of the Elementary School

Recently, I spent a pleasant day at Chatsworth Junior School, located in a quiet, residential section of southeast London. Undamaged by the war, it is a modern brick structure as neat and tidy as an English garden. Its operation is simple and efficient. Each fall, a class of about one hundred youngsters commence their new labors at one end of the long, one-story building. Four years later, shepherded by a faculty of twelve, and under the watchful eye of the headmaster, they emerge from the other end. Most elementary schools in England, Chatsworth being no excep-

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tion, practice some kind of ability grouping, but no child is held back on this account. Promotion is on an age basis.

Chatsworth is not typical. It manages to place about 50 per cent—roughly five times the national figure—of its graduates into one of the area's secondary grammar schools. These schools, which have no counterpart in the United States, are college preparatory institutions. Although, in most cases, free and state supported, they are highly selective. It is a rare parent of one of Chatsworth's young scholars who doesn't hope for a grammar school place for his child.

Administrators and teachers agree that discipline is no problem at Chatsworth; neither is there rule by fear. Anyone looking for the stereotype of the formidably stern English schoolmaster would come away disappointed. The children appeared well-mannered, yet free in their expression. A group of pupils approached me during lunch hour, wanting autographs. I took advantage of my status as somewhat of a visiting celebrity to talk to them at length about themselves and their school. Few better ways may be found for judging the morale of a school.

The elementary school is a highly autonomous unit, the headmaster being in complete charge of the school's internal operation. Curriculum is a matter which each school decides for itself in large measure. At Chatsworth, the teacher had maximum independence in determining method and specific content within prescribed subject areas. The teacher at this level is assigned a certain class, and with few specialized exceptions, is responsible for instruction in the full range of the usual elementary subjects. Language arts and arithmetic are emphasized at Chatsworth for a reason which seems to me to give the junior school one of its main reasons for being—the all-important common entrance examination.

Each spring, all eleven-year-old pupils in England take a series of standardized intelligence, language arts, and arithmetic tests, collectively known to all as the common entrance examination. Whether a student goes to a secondary grammar school, a secondary technical school, or a secondary modern school is determined almost exclusively by his performance on this examination. As pointed out earlier, the first of these schools is highly academic, and admits only those who pass highest. Chatsworth's headmaster told me that this usually means students with an IQ of around 120 and up. The technical schools of various kinds take those who pass next highest. To the modern school—a general education institution accounting for perhaps 75 per cent of the nation's secondary school population—go the rest. I have no doubt that these different types of secondary schools are ranked by most according to the ability level which they accommodate. Grammar school is generally considered "the best." I was told that the modern school is generally referred to among the parents of Chatsworth's rather academically select children as the

"dud school." Transfer from one to another of these schools after admission is possible, but not probable. Practically speaking, the nature of the student's secondary education is determined the moment he lays his pencil down at the end of the common entrance examination.

The future role of the junior school is a topic in which Chatsworth's teachers are interested and, to some extent, divided. There are those who feel that the common entrance examination is still the best way. They have charts and statistics to indicate that the most capable, all-around students are the ones who pass highest. Many of them do not deny the possible psychological impact on those who do not, but feel that this difference in abilities is an immutable fact which everyone must face sooner or later. Among others at Chatsworth, however, there is a question as to the value of a procedure which tends to straightjacket elementary education into too much emphasis on content at the expense of more all-around individual development. There is a growing body of opinion among English educators favoring elimination of the common entrance examination altogether in favor of automatic transfer to a comprehensive secondary school.

"Three Schools or One"

In simple terms, the comprehensive idea is to bring all secondary pupils in a given area under one educational roof; in other words, an English version of the American high school. This is not a new idea in England, but until the postwar period of compulsory secondary education, it enjoyed little vogue. The fact that London, the largest educational authority in England, has committed itself to the building of some twenty such schools, has made the "Three Schools or One" issue one of the most controversial topics in English education.

The main argument put forth in favor of the comprehensive approach is sociological rather than strictly educational, namely that the present tripartite system has a divisive rather than a unifying effect. How, maintain the advocates, can one educate for democratic living in an educational system which separates, rather than brings together, the future citizens of that democracy?

The defenders of the status quo, admitting that it has its faults (what human organization hasn't, they ask), contend that the comprehensive school is no solution. Biggest opposition comes from the grammar schools, fearful lest their proud academic tradition be engulfed in a large, impersonal, and intellectually leveling system, which is so busy keeping track of its pupils that it has little time to educate them. The question of size is of paramount importance, for a strongly held idea in English education is that a school should never be larger than a headmaster's ability to know his pupils. This would obviously be impossible in a comprehensive

school. London, for instance estimates its schools will average about two thousand pupils each, a figure which strikes a note of horror in the heart of many an English schoolmaster.

A few comprehensive schools are now in operation (the *Ministry of Education Report*, 1952, puts their enrollment at 8,356, or less than one per cent of the total secondary school population of England and Wales). Recently, the *Times Educational Supplement* published a detailed account of one such school with an enrollment of about one thousand. This figure provoked some comment as it is somewhat below what most English educators think would have to be the size in order to maintain as full a curriculum as is now offered in the separate grammar, technical, and modern schools. I, myself, visited a limited comprehensive type of about eight hundred pupils on the outskirts of London. Isolated examples such as these are being watched with interest, but meanwhile, the argument continues unabated. The recent announcement that London's first truly comprehensive school to be opened soon in southeast London would absorb one of the area's grammar schools brought a storm of protest from irate parents.

Only time will tell whether the comprehensive school will become a permanent part of England's educational picture. In a country where evolution is the rule, but where tradition dies hard, the issue is far from settled.

Secondary Technical Education

If changes in English society have set the stage for the comprehensive controversy, they have also brought agreement on at least one educational issue—the need for more and better technical schools. The increasing mechanization of twentieth century society, pointed up sharply in two world wars, has forced England to realize the necessity of a technological education to help provide the country with the skilled body of workers on which industrial progress depends. With this end in mind, the 1944 Education Act provided for the establishment of a system of free, state-supported technical schools. At present these schools enroll about 5 per cent of the secondary school population—a percentage, generally speaking, of above-average intelligence.

Chartesey Secondary Technical School, which I visited, is located in an industrial section of London close to the heart of the city. Opened in 1950 and with a current enrollment of about three hundred fifty boys, the school is doing a yeoman job in making the best of rather inadequate physical facilities. Coordination is aggravated by the fact that the school has overflowed its original building—overcrowding is not a problem of American schools alone—and must accommodate many of its pupils in a second building about one-half mile from the main site.

At first glance, Chartesey's curriculum, as in all technical schools, bears strong resemblance to that of the usual American high school. Indeed, first-year students are programed for only a few hours a week of technical subjects. This is explained in light of the technical schools' aim of giving a broad, general education along lines which emphasize technology. In no sense can secondary technical education be considered narrowly vocational in nature. The prevailing idea is rather that highly specialized preparation for a given trade is better postponed to a later stage. It is felt that such an arrangement is most beneficial to the individual, his chosen trade, and the community at large. Chartesey's bias or technological emphasis becomes obvious when one observes the applied rather than abstract nature of much of the teaching, especially in mathematics and science. The background of the faculty facilitates this in that many of the teachers come into teaching via trade and industry rather than from a university or teacher's college. To prevent this emphasis from dominating the curriculum and making the approach too narrow, and yet still differentiate technological education as such is a delicate problem of balance which is one of the major problems of the technical school.

As Chartesey's first group to finish the complete course did not leave until the end of 1953, it is still too early to see any post-school pattern emerging. The school's closest ties are with the printing industry, and some of the older boys have already left school to start apprenticeships in this trade. Recalling what was said earlier about balance between general and technical education, Chartesey's headmaster voiced some concern about possible domination of the school's program by the requirements of this one industry.

An interesting feature of the English plan of secondary technical education is its variety, different schools usually emphasizing different trades or crafts. The particular emphasis is often determined by the occupational environment in which the school operates. Close liaison between the schools and the appropriate industries and trade unions is encouraged in order to make the over-all program more effective. I was told that the engineering and building trades are the ones most commonly linked to the school in this way.

It is still too early to evaluate this program of technical education. It must pass both a practical and a social test. In the first instance, can it convince employers and trade unions that its philosophy of and approach to technological education will bring results in the form of more skilled and productive workers? Secondly, it must establish for itself in the community a status position, for while the country realizes the necessity for skilled craftsmen, too many young people of ability are still conditioned to the idea that it is better to work in a white collar than in a pair of overalls.

CURRENT EVENTS AND MATERIALS IN HOMEMAKING EDUCATION

BY HELEN S. POULSEN*

The curriculum in homemaking education is concerned with the fundamental values and problems of the family. Changes that affect the family are occurring so rapidly today that it means constant evaluation of methods and materials. This continuous re-examination is reflected in the local, state, national, and even international conferences and workshops attended by homemaking education personnel as well as in the materials read and developed by them.

In-service Workshops

Several in-service workshops were held last summer under the direct sponsorship of the Bureau of Homemaking Education.

Family Relationships

The area of family relationships was dealt with in a week-long workshop for homemaking teachers in Los Angeles County. Bernice and Harry Moore from the Hogg Foundation, Austin, Texas, were the consultants and did much to establish basic philosophy as well as procedures about the teaching of family relationships.

Home Furnishings

The area of home furnishings comprised two workshops: one held at Corona, California Junior High School and the other held at California State Polytechnic College, San Luis Obispo. The one in Corona was given

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for the secondary school homemaking teachers in Riverside and San Bernardino Counties. Each participant adapted a nearby tract home to the special characteristics and needs of a case family. The workshop at San Luis Obispo emphasized the preparation of draperies and decorative household linens, procedures in simple upholstery problems, and teaching aids and methods for presenting these projects to secondary school pupils.

Clothing

At Bakersfield College, a ten-day workshop in the preparation of teaching aids for instruction in clothing construction was held. The majority of the participants were homemaking teachers without adequate training for teaching homemaking, although they were expected to teach the subject in elementary schools. A five-day clothing clinic was held at Orange High School for the secondary homemaking teachers in that county.

Teachers Plan Own In-Service

The North Central Coast Homemaking Teachers' 1958 Annual Conference was held from 9 to 3 on Saturday, October 4, at James Lick High School in San Jose. Each year emphasis is placed on a different area in homemaking. The theme this year was "Management for Better Living."

Fourth Annual Conference of Vocational Homemaking Teachers

The annual conference of Vocational Homemaking Teachers was held at the University of California, Santa Barbara College, Goleta, California, August 18–21. The theme was "Curriculum Development; A Creative Experience." The conference leader was Dr. Robert Fleming, Chairman, Early Childhood and Elementary Education Department, New York University.

Annual State F.H.A. Meeting

This year the annual Future Homemakers of America Conference at Asilomar was held on October 17–19. Increased membership made it necessary to enforce strictly the limiting of attendance to qualified delegates. There were 262 chapters in the State of California for the school year 1957–58, which is an increase of twenty-eight chapters over the previous year.

National Meetings Attended by California Home Economists

The Home Economics Education Branch in the U.S. Office of Education periodically sponsors regional and national conferences for workers in home economics education. These include city and state supervisors, heads of college and university departments, teacher trainees, and master teachers. Regional meetings are held about every two years and are

planned cooperatively by the membership. The western region, which includes the eleven western states, Alaska, and Hawaii, will meet next in Denver during the week of November 9–13, 1959. National conferences are called about once every five years. Two national conferences were held in Washington, D.C. early this year to explore ways to improve home economics education; one for supervisors in December 1957, and one for teacher educators in February 1958.

International Congress

Five California home economists attended the Ninth International Congress on Home Economics in College Park, Maryland, during the week of July 28 to August 2. This is the first time this Congress has met in the United States. Paris has been chosen for the site of the next Congress, which will be held in 1963. In addition to discussion groups and plenary sessions, the Congress program included field trips to points of professional and cultural interest. Delegates from foreign countries spent one evening with an American family. There were 1,044 representatives of home economics professions from fifty-nine countries.

Five New Bibliographies

The Bureau of Homemaking compiled four new bibliographies for the California State Conference for Vocational Homemaking Teachers, as follows: "Recent Pamphlets and Booklets," "Current Films and Filmstrips," "Recent Homemaking Textbooks," and "References on Curriculum." In addition, "An Annotated Bibliography on Home and Family Living," by Mrs. Dorothy C. McKenzie, was made available.

Trends in Homemaking

Miss Margaret Pritchard, supervisor of Homemaking in Berkeley, representing California on a panel of sixteen specialists, presented trends in sixteen areas of homemaking in the June 1958, issue of "Forecast." This issue, devoted to implications in research and teaching aids, merits a careful study. Bibliographies are included in each article.

Grouping in Home Economics

The Department of Home Economics National Education Association has published in 1958 a much needed and very well presented bulletin for homemaking teachers: "Grouping for Effective Teaching in Home Economics."

Clarification of One of the Roles of the U.S. Office of Education

In the August 1958 issue of "Marriage and Family Living," Miss Edna P. Amidon not only describes the "Contributions to Family Life

Education by the Office of Education," but defines and gives examples of effective homemaking programs.

Creative Thinking, a Challenge to Education

In the February 1958 issue of the "Journal of the American Dietetic Association," Dr. Francis A. Cartier, Professor of Communication, Maxwell Air Force Base, provides a real challenge in a stimulating article, "Blazing New Trails in Thinking." He reminds us that: "*Things change*; prices change; staffs change; population statistics change; even viruses change. And the result is always that the *problems* change. Even if you solved all your problems today, you would have a complete set of new ones next week. Some of the old ones might be back, but they *never* come back exactly the same. You need *new* solutions even for old problems. I mentioned some of the villains—routines, policies, habits. What are these? They are old solutions to old problems. They are proved. They worked. Of course they did—on the old problems." His last words are "*Do* you dare to be creative?"

Clarification of Scientists' Viewpoint

Dr. John R. Mayor, Director of the Science Teaching Improvement Program of the American Association for the Advancement of Science, was the speaker at the second general session of the American Home Economics Association's 1958 annual meeting, June 23–27. The September issue of the "Journal of Home Economics" contains an article adapted from his address, "National Issues in Education Today." Dr. Mayor states:

> "It cannot be overemphasized that the scientists are trying to determine ways in which the schools can make the best possible use of the time presently available for the study of mathematics and science. Few scientists are advocating that there be additional requirements in science and mathematics at the secondary school level.
>
> "Scientists must find a way to make a more useful contribution to other disciplines, such as home economics, in which the applications of science become critically important to the welfare of society."

Keeping Up With Man-Made Fibers

Periodically the "Textile World" publishes a man-made fiber table. In a brief article in the September 1958 issue of "Textile World," changes are highlighted in the man-made fiber field during the last twelve months since the publication of the September 1957, man-made fiber table.

Classroom Teacher Develops Nutrition Material

A fresh approach to nutrition teaching is given in the new filmstrip and pamphlet, "Quick Meals for the Family," developed and written by Kay

Thody, a homemaking teacher in Frick Junior High School in Oakland. *One basic meal* pattern is used which can be applied to any meal, snack or party, eaten at any time in any situation. This approach recognizes the wide cultural variations in families and the fact that most students are interested only in what they eat "now." Recognition is also given to variation in students' abilities in suggested methods shared by other teachers with the author. A local industry underwrote the costs, including remuneration to the teacher, and produced the film and accompanying pamphlet.

In California the filmstrip is available free of charge through the Dairy Industry Advisory Board, 1215 O Street, Sacramento. Outside of the State it may be available through the local organization of the dairy industry.

Just Off the Press

Homemaking teachers and parents will welcome the new attractive 16-page booklet, "A Good Breakfast for a Good Day." The author, Mrs. Marguerite Fenner, stresses what makes a good breakfast and why one is needed. Included are recipes, short cuts, and hints on planning breakfasts.

For further information contact: Mrs. Marguerite Fenner; Director, Home Economics, Pacific Gas and Electric Company, 245 Market Street, San Francisco.

National Survey on Household Food Consumption

There are many implications for teaching methods and course content of nutrition, foods and family management in the recent reports based on the nationwide survey of household food consumption made in April–June, 1955, by the Agricultural Research Service and the Agricultural Marketing Service of the U.S. Department of Agriculture. The first thirteen reports are mainly concerned with food consumption and dietary levels of households in the United States, by region. The most recent report deals with home baking by households in the various regions, comparing urban and rural households. Included are comparisons of household practices with respect to home baking, use of mixes, and purchasing of bakery products. It is planned that future reports will include information on food consumption and dietary levels of households as related to age, education, and employment of the homemaker.

Publications in series (1–13) "Household Food Consumption Survey, 1955," can be purchased from Superintendent of Documents, Washington 25, D.C.

Vocational Opportunities

SENIOR HIGH SCHOOL TERMINAL STUDENTS

Across the United States there has been an increased interest in the vocational opportunities and the skills required for success for terminal

high school students majoring in homemaking. In California, Berkeley High School has a pilot program for seniors who are terminal high school students. This exploratory course is in the area of food service. As a prerequisite, students must have had foods in high school and must show some evidence of ability in the area of food service.

Junior College Terminal Students

In California there has been a special concern in isolating vocational opportunities for junior college terminal students. A new field was opened with the announcement in June that the Alameda County Medical Institution is now offering an internship in housekeeping that would begin on July 1 for a period of one year. The applicants should be between the ages of twenty-five to thirty-five and should have two years of college in either *home economics*, teaching, business, or nursing. The announcement stated that: "As there is a definite shortage of qualified housekeepers, positions should be available at all times."

University Graduates

Under the supervision of a committee of the California Home Economics Association, a 15-minute motion picture in color is being completed, showing *California* home economists at work. Home economics training can lead to such a wide variety of professional opportunities that it is not possible to show all of them in one film. However, a broad sampling is effectively shown. Home economists at work in California will be seen in the areas of teaching, extension work, nursery schools, dietetics teaching, and business.

Public Relations at the Junior High School Level

Mrs. Dorothy Hamrock and her *students* of Aptos Junior High School in San Francisco have developed a series of slides and have written the accompanying narration explaining the homemaking program in their school. Of course, the students themselves gave the narration when the slides were shown to an enthusiastic audience.

In Oakland a filmstrip has just been completed, explaining the homemaking program in the seventh, eighth, and ninth grades in this city. Three teachers and three classes were involved in the planning and taking of the pictures. Although this filmstrip was developed especially to be used with parent and community groups, teachers are planning to use it with counselors and other faculty members and with their students.

WHAT'S HAPPENING IN CALIFORNIA SECONDARY SCHOOLS

BY WILLIAM N. MCGOWAN*

What's Happening in Junior High Schools

Berendo Junior High, Los Angeles, has been experimenting with "non-privilege" homerooms. Such classes were established to serve a two-fold purpose; one a deterrent, the other disciplinary. As a deterrent, it was hoped that such a non-privilege situation would compel those students often inclined toward behavior designated as unsatisfactory, to give second thoughts before committing acts that lead to unsatisfactory marks. As a form of discipline, a non-privilege placement would realistically impress pupils that unsatisfactory behavior is not accepted, therefore, normal school privileges are withdrawn until acceptable behavior is evidenced.

The administration, with the counselors, transfer a pupil from regular homeroom to non-privilege homeroom if there are three (3) or more U's (unsatisfactory marks) in Cooperation on the five-week report card. A "regret" letter is sent home to the parent, and a master list is circulated to each faculty member. Parents are encouraged to visit the school and conferences are arranged with the teachers.

A pupil assigned to non-privilege homeroom is deprived of the following activities: eligibility for graduation, participation in all athletics and clubs, attendance at assemblies, dances, noon movies, and all extra-curricular events. Also, hall passes during class periods are not granted.

Each Thursday, non-privilege pupils carry weekly progress reports (attached) to all of their classes. These are taken home for parent signature and returned on Friday to the non-privilege homeroom sponsor. Only after three consecutive perfect cards (no U's), are pupils returned to

* Executive Secretary, California Association of Secondary School Administrators.

their regular homerooms. A letter of congratulation is sent to the parent and the faculty is informed of the pupil's regular status.

The administration, counselors, non-privilege teachers, and health coordinator, conduct weekly conferences on behalf of the "continued inhabitant" to develop a more intensive program of rehabilitation. Mimeographed copies of the study and its recommendations are distributed to the youngster's teachers.

In the nearly two-year period of this program's existence, frequent discussions with the 300 pupils serviced by the non-privilege homerooms have convinced the staff at Berendo that the students are being helped by this program. The 50 per cent return rate validates this statement. A recent faculty survey, to evaluate the effectiveness of this experiment, resulted in overwhelming support and recommended the non-privilege homeroom continue.

Castro Valley Elementary School District has been engaged in an extensive revision of the curriculum and organization of its two seventh and eighth grade schools—Earl Warren and A. B. Morris.

Operated in the past largely on a self-contained classroom basis, the new program now calls for departmentalization, redesigning some classrooms, hiring teacher-specialists, new attendance and report card procedures, curriculum reorganization, revamping of counseling and guidance procedures, and a "crash" program of articulation with the local high school.

Basic reasons given for the changes:

1. Specially trained teachers will do a better job teaching such subjects as science, music, art, shop, homemaking, and mathematics.
2. Teachers can be more effective when planning for one subject than they can planning for many.
3. More efficient use of teacher time and classroom space will be possible.
4. More efficient use of equipment and supplies will be possible when these can be grouped in special classrooms instead of being spread thinly amongst all.
5. Better transition from the elementary schools to the high school will result.

The three-period Core classes will be taught by a single teacher. Thus, each student will have five different teachers daily, one of whom he has for nearly a half of one day. The Core teacher will act as counselor, and will be responsible for handling two Core classes per day. Periods will be

approximately forty-four minutes in length with a double lunch period of thirty minutes each. There are no electives, individual student programing being impossible with limited secretarial and administrative staffs at the two schools.

Classes will be homogeneously grouped according to achievement scores, with some overlapping to permit flexibility of student assignment. More able students and those requiring remedial programs will thus fall into separate classes. Curriculum content and teaching techniques will be specialized to meet their needs.

What's Happening in Four-year and Senior High Schools?

A fine example of creative science teaching is currently being demonstrated by the science staff of *Santa Paula High School* in Ventura County. In January of 1956, a dead sea lion was discovered on the beach front by a staff member of the Ventura County Schools office, Everett Buchan, and the local high schools were subsequently apprised of its existence. The Santa Paula High School science department reacted to the challenge and permission was secured from the Navy to remove the animal from Navy property. The sea lion, weighing 500 to 600 pounds, was hauled to the Santa Paula High School campus by truck and buried in the center of the football field.

Under the direction of Santa Paula science teachers, Joseph Ricards and Neal Currier, the animal was imbedded in order that science students at the high school might study the effects of burying a large mammal. Students discovered that bacteria worked more slowly than might be expected. The sea lion was buried in February 1956 and the ground was first opened in March 1957. When the students discovered that the body had not decayed sufficiently, pipes were put down so that beetles and flies might get to the carcass.

In December 1957 the grave was again opened. This time students discovered that fly larvae and beetles had completely cleaned the skull and greatly reduced the bulk of the body. At this point the head was removed. Later the grave will again be opened, and if the bulk has sufficiently decayed, the students plan to remove and clean the bones. They will then be left in a disarticulated state so that teachers and the students can number the bones and construct an accompanying key. They will thus have a first-rate instructional aid for biology and zoology classes.

"Next Steps" for Secondary Schools were proposed by Dr. Frederic T. Shipp at the CASSA Summer Workshop held August 19–21 at the campus at San Francisco State College. Dr. Shipp made the following points:

FACULTY: *Improve the quality of instruction by better use of staff through*

1. Faculty "teams" (two or more) for intra-subject improvement and utilization of special skills of each member
2. Faculty "teams" for inter-subject improvement
3. More professional use of teachers for instruction and guidance
4. Part-time teachers from the community who are fully-credentialed
5. Para-professional assistants for sub-professional services
6. Clerks used for routine, detailed duties, instead of teachers
7. General aids for control and supervision of building and grounds
8. Graduate assistants from nearby colleges or universities
9. Lay readers from the community to read papers, etc.
10. Community consultants as special resources (voluntary or paid)
11. Experienced teachers to assist new teachers
12. Improved faculty meetings through sharing in purpose, planning, promptness and participation
13. Lay advisory groups for different subject fields, as in trade courses

PUPILS: *Maximum opportunity for achieving self-realization and social effectiveness through*

14. Development of civic responsibilities within school for maturing students
15. Encouragement of community leadership and service experiences
16. Positive programs of character development; wholesome attitudes
17. Reappraisal of the effectiveness of the formal "citizenship grade"
18. Work experiences of all kinds for all types of students
19. Functional leadership role of student council in and out of school
20. Reassessment of extra-class activities in terms of goals
21. Club programs related to extended subject class activities
22. Honors program for gifted students
23. Restudy of graduation concepts: over-emphasis, at all levels
24. College credit for additional high school work
25. "Sub-collegiate" course experiences at twelfth-grade level
26. Program for the 50 per cent not going on to college, one-half of whom will go into services or sales
27. "Selling" public education to students for further education, a career, or later adult cooperation
28. Emphasis on "how to study" and "why study," as well as "what"

PARENT-COMMUNITY: *The cooperative involvement of laymen through*

29. Maximum utilization of community resources: persons, places, things
30. Permanency and functions of citizens committees

31. Appraisal of effectiveness of parent organizations
32. Orientation of parents to each new educational level
33. Conference devices for teacher-parent relationships
34. Mechanization of the report card
35. Other community agencies carrying greater responsibility for youth services
36. Improved public relations through annual reports, house organ, promotional publications, student publications, parent-teacher leaflets, curriculum reports, and report cards

CURRICULUM AND GUIDANCE: *Better designs to serve all levels of ability, interest and aspiration through*

37. Sounder subject sequencing: especially mathematics, science, and social studies
38. Use teacher-pupil planning: more student responsibility
39. Amount, continuity and grade placement of the "common learnings"
40. Use of newer teaching aids: television, radio, records, tapes, films, etc.
41. Application of newer teaching methods; teaching-learning process
42. Restudy of State required subjects: e.g., physical education, etc.
43. New emphasis on science and mathematics—more of the same, or new courses (Cf. new physics course by National Science Foundation)
44. Modernization of foreign language program: functional approach
45. Revamping of twelfth-grade program to avoid "Senior Slide"
46. Revamping of eighth-grade program, making it more challenging
47. Materials center for future use by other groups and individuals
48. Project area for individual and group activity
49. Camping and other outdoor activities
50. Use of modern evaluative techniques and instruments
51. Closer ties with preceding educational unit in discovering abilities and aspirations of pupils
52. Closer relationship of curriculum and guidance within the school program
53. Better use of counselor's time and services (less load, paper work)
54. Use of teachers as part-time counselors in or out of class (e.g., social studies classes carrying "home room" activities)
55. Reappraisal of the role of the "home room"
56. The adequacy and use of a testing program as an aid to counseling and for curriculum improvement
57. Follow-up studies of graduates, in college or at work
58. Follow-up studies of drop-outs; data used for improvement of program

59. Provide classroom teachers with useful information on pupil background and specific needs

ADMINISTRATION: *Improved organization and management of the school through*

60. Participation in the accreditation program of CASSA
61. Adequate facilities, equipment and materials of instruction for all subject fields
62. Variety of class sizes for different purposes
63. Criteria for grouping of students
64. Study hall vs. the extended class period
65. Schools-within-a-school; smaller units for the large high school
66. Expanding the summer school
67. The 4-quarter (all-year) school
68. Freeing the junior high school from senior high school "domination"
69. Reorganization of administrative units: K-6-3-3-2; 6-3-3-3 or the 4-4-4-3 (each a 15-year program)
70. Shorter summer vacations and longer Christmas vacations
71. Merit ratings vs. special assignments according to skills
72. Better design for new plants (effect of light, color, sound and space)
73. More efficient and economical use of school plant and grounds
74. Adequate utilization of such large units as: library, cafeteria, gymnasium, shops, administrative offices
75. Analysis of duties (and amount of time spent thereon) of the principal: his duties as supervisor, organizer and manager
76. Also, the vice principal, assistant principals, counselors (special and general), activity directors, department heads—their duties
77. Better coordination between general, technical and continuation high schools
78. Reduction in demands of central office and staff
79. Use of interns and externs for special studies and services
80. Cooperative relations with and use of educational departments of nearby colleges and universities
81. "Discipline" developed through a positive program for citizenship within the school
82. Practice cooperative leadership and shared responsibility with faculty and students
83. Develop a systematic program of interpreting the school to the community
84. Continuous evaluation of the many school activities in terms of the goals to be achieved
85. Closer liaison with preceding and succeeding educational units

SCHEDULES AND SCHEDULING: *A master key to successful operation of the modern secondary school*

The master schedule (1) reflects the *philosophy* of the school; (2) is *comprehensive* in providing maximum experiences for the largest number; (3) is *inclusive* of all or most major activities within the school day; (4) is *flexible* in structure and simple in design; (5) is *integrative*, enabling the school to operate more effectively; and (6) is *functional*, utilizing the full resources of the school-community.

During the past decade, forward-looking administrators have developed master schedules through

86. Rearrangement of the *school day*: single, double, triple, or staggered sessions
87. The revised *school week* and "*school year*" (longer than the 175 day minimum)
88. *Block scheduling* of different subjects, permitting flexibility of activities, teaching and guidance
89. *Additional periods* to provide for full program (daily or occasionally)
90. *Double period* for same group of students, with same or different teachers
91. *Double period* becoming a single two-hour period which encourages fusion and correlation
92. *Core program*, with two or three periods under one teacher, covering common learnings, guidance, and extra-class activities
93. *Flexible activity period* (daily or occasionally), providing for all major school activities, maximum participation of students, and total direction by all faculty members
94. *Floating activity period* (daily or occasionally) for extended subject class activity and supervised study
95. *Rotating schedule* to avoid favored hours for subject periods and for extended class periods
96. *Longer class periods*, daily or rotated during the week; five, four, three, two, or even one, instead of the traditional six
97. *Vertical and horizontal schedules*, providing maximum flexibility with extra periods for special activities during the week
98. *Study Day*: one day a week free of regular class periods, for informal guidance, independent study and activity, field trips, and community activities
99. *Alternate Day School*: two complete schools operating every other day (Monday through Saturday)

SYMPOSIUM

Modernizing High School Mathematics

No one denies the fundamental place of mathematics in the curriculum of the elementary or of the high school. Especially in this scientific age does mathematics legitimately claim to lie at the heart of education, both in the training of scientists and in the general education of everyone. However, no one appears to be satisfied with the present program of mathematics in our schools. If adequate education in mathematics is so necessary, and if the current program is so inadequate, what should be done? The questions being raised are insistent and pointed: Why is mathematics so widely disliked and shunned, especially by girls? Why do we require only one year of such a basic subject for high school graduation? Why do we emphasize mathematics less in our schools than do the Europeans? Is there a new content, even in this seemingly changeless subject of mathematics, that should be adopted in the schools? Will all mathematics teachers need to be restrained before they are able to teach the new "modern mathematics"? These are but examples of the perplexing questions which press for answers.

This symposium is addressed to teachers of all subjects, to administrators, to citizens, especially those who serve on boards of education, to all who are genuinely concerned with bringing the total educational program of the high school up to standards required by the demands of living in today's world.

Appreciation is expressed to all contributors, especially to Lucien B. Kinney, Professor of Education, Stanford University, a long-time leader in mathematics education and teacher education who not only coordinated the symposium but also wrote one of the major articles.

THE STATUS OF REFORM IN THE MATHEMATICS CURRICULUM

BY MORRIS KLINE*

There is considerable agitation in mathematical circles for reform of the high school mathematics curriculum. Several groups at work on the problem have been publicizing their efforts by talks, articles, pamphlets and demonstrations. The publicity has the force of almost haranguing

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teachers and administrators to institute the new proposals or to start, at least, immediate preparation for the changes being advocated. One gets the impression that the ideal curriculum is at hand and that it contains the solution to the difficulties several generations of teachers have encountered in putting mathematics across. Lest teachers or administrators be impelled to hasty actions it seems desirable to examine the nature and status of the reforms being pressed.

The interest in reform is both understandable and commendable. There is rather universal agreement that the present mathematics curriculum is poor. In fact the evidence is unmistakable. The vast majority of the students who take mathematics dislike it. Hence they take as little as possible and are happy to be through with it. Even college professors, men of intelligence and ability, complain about the meaninglessness of the mathematics they took in high school and in college. Hence improvement in the curriculum is not only in order but long overdue.

Several organized groups have been working on new curriculums. The most prominent at the present time are the Commission on Mathematics of the College Entrance Examination Board and the University of Illinois Committee on School Mathematics, the latter headed by Professor Max Beberman. A third group, whose official title is yet to be announced, held its first major session at Yale University this past summer. The unofficial patron of this last mentioned group is the American Mathematical Society. Yale University is merely the administrative headquarters.

The publicity given to its own work by the Commission on Mathematics has been almost continuous for the past three years. In particular one seemingly definitive article written by Dean Albert E. Meder, the executive director of the Commission, was published in *The Mathematics Teacher*. The importance attached to this article by the Commission may be judged from the fact that tens of thousands of preprints were distributed around the country in the spring of 1957, about six months before the article appeared in print. If one were to assess the position and recommendations of the Commission by the publications and talks given by the members then one would conclude first of all that the chief trouble with our present curriculum is that we are teaching outmoded or useless topics. The Commission also seems to be saying that we have been teaching processes or mechanics at the expense of ideas. To replace the outmoded material the Commission recommends such topics as symbolic logic, Boolean algebra, the theory of sets, topics of abstract algebra such as groups, rings and fields, topology, rigorous derivations of the properties of the various types of numbers and of the theorems of geometry, and abstract postulational systems. These topics are labeled modern mathe-

[1] Meder, A. E., Jr.: Modern Mathematics and its Place in the Secondary School, *The Mathematics Teacher*, V. 50, October 1957, pp. 418–23.

matics and are to be used to mold the substance and point of view of the new curriculum. The extent of the publicity on behalf of this new material has been so great that the words "modern mathematics" have become almost a commonplace in all discussions of reform. Moreover teachers have been advised and even warned that they will have to teach these new topics and have been urged to educate themselves along these lines. A number of the summer and academic year institutes have devoted their entire programs to "modern mathematics."

Despite several years of campaigning for modern mathematics the Commission has recently drafted a report on its activities, which it intends to submit to the parent body, the College Entrance Examination Board, and this report recommends a rather different program. (A preliminary version of the report was sent to a number of professors for criticism and so its contents are rather well known.) This report proposes a first-year algebra course not very different from the present one. The only notable change is the inclusion of some topics from the theory of sets. The second year is to be devoted to a brief presentation of about twelve theorems of plane Euclidean geometry; some solid geometry is to be mixed in and to replace the usual one-semester course in solid geometry; and coordinate geometry is to be introduced and used to prove other results of Euclidean geometry. The third year is to be devoted to more algebra and trigonometry, pretty much as present. For the fourth year three possible one semester courses are suggested: a course in mathematical analysis, a course in probability and statistics, and a course in abstract algebra. Schools will choose two of these.

When one tries to assess the recommendations of the Commission in the light of the above information one is almost nonplused. The latest recommendations seem to be very much at variance with all the talks and articles which the Commission had put forth in preceding years. When confronted with a seeming about-face, some members of the Commission have denied that there has been any despite patent evidence to the contrary; a couple of members have privately admitted that the Commission has altered its position. In the opinion of the present writer neither the old nor the new position of the Commission has much merit. The modern mathematics stressed during the past few years is trivial in importance compared to the topics currently taught and hopelessly beyond young people because of its abstractness and rigor. Moreover the argument that mathematics becomes outmoded is valid only for an occasional topic. The aspects of mathematics recommended hardly begin to do justice to the creative and intuitive aspects of the subject and its value for other fields.[2]

[2] For a fuller criticism see the article by Kline, Morris: The Ancients Versus the Moderns, A New Battle of the Books, which will appear in *The Mathematics Teacher* in the October or November 1958 issue. See also a rebuttal by Dean Albert E. Meder, Jr. in the same issue.

The newer recommendations contained in the report to the Board are hardly significant. The only changes of note, the incorporation of solid geometry in the second year in place of a fourth-year course and the substitution of analytic geometry for much of Euclidean geometry, have dubious merits. The latter recommendation in particular seems to the writer to be definitely ill-advised. However, regardless of the merits or demerits of the Commission's old or new program the outstanding fact is that the schools still have nothing to work with. Though the Commission has promised actual materials for the four-year curriculum, as of this writing only a paperbound treatment of probability and statistics has appeared. As already noted this material, if usable, would be for a fourth year, one-semester course. Certainly no experimentation of any sort has taken place, to say nothing of experimentation by unbiased teachers operating in the usual classrooms.

The program and status of the Illinois Committee on School Mathematics is somewhat different. In fact Professor Beberman stresses that his program is not to be confused with that of the Commission. It is relatively easy to describe the *status* of this committee's work. The committee has prepared materials for the four years of high school, each year's work being covered in a separate volume. However the committee will not release to the teaching public the last three volumes because, it says, it is not satisfied yet with the contents. Even the first volume, which is available, is issued subject to revision. Experimentation restricted to teachers and schools chosen by the committee, is taking place.

However it is by no means easy to describe the program and objectives of the committee. No principles or objectives have been announced. Professor Beberman says, in fact, that the subject matter is not critical; young people have their own values and can be interested in many topics which adults may not care for or deem important. To discern what this committee is striving for one is limited to an examination of the one volume that has been issued. There one notes some attempt at integrating the usual subjects. Some effort to lead students to draw their own conclusions is also apparent. Insofar as content is concerned there is very little difference between the traditional material and that in the present volume. There are indications that coordinate geometry will replace a good deal of Euclidean geometry in the second year's work and that the geometry will be rigorous and abstract, but one can't be sure of this. One does note the use of set concepts to discuss the values of X that may be substituted in equations, inequalities, and functions and the inclusion of some symbolism and truth tables to explain the usual logical connectives such as "and," "or," "implies," "negation," and so on.

When one tries to assess the program of the Illinois Committee one is balked by the lack of explicitly stated objectives and the fact that only one year's work is available for inspection. The impression gained by this

writer is that some of the simple concepts such as solving for unknowns are treated to excessive length and are unnecessarily heavy-handed. On the other hand the authors attempt very sophisticated distinctions such as that between a number and a name for a number and that between the ordinary whole numbers and directed numbers. The attempt to subsume all uses of letters under one general concept in the very approach to these uses and the attempt to introduce modern logical concepts are also highly sophisticated. In some cases these sophisticated versions are, in effect, abandoned when the authors advise students to ignore distinctions and more elaborate phraseology when they operate with numbers and letters.[3]

However for the purposes of this article any evaluation of the merits and demerits of the Illinois program is irrelevant. The major point is that the last three years of work are not available for inspection and even the first year's work is subject to revision. The experimentation undertaken thus far is entirely under the supervision and jurisdiction of the Committee. Hence whatever this may indicate one must be concerned about hand-picked teachers, hand-picked students, and the possibility that students who are told that the eyes of the mathematical world are upon them will make special efforts to shine. The problem of motivation is thereby sidestepped. The reasonable position to take is that not until the Committee is itself satisfied with the entire four-year curriculum and releases it for inspection and not until free experimentation is undertaken can there be any thought of adopting the Committee's curriculum in the schools.

It is perhaps unnecessary to add that insofar as the group administered at Yale is concerned nothing favorable or unfavorable can be said at this stage of its efforts.

There is one other thought worth entertaining at the present time. Is there any other suggestion for reform of the mathematics which may be worth trying? There is and I should like to sketch one. It seems to the writer that the present difficulties in putting mathematics across are not due to a poor curriculum. A few topics, such as the logarithmic solution of triangles still commonly taught in trigonometry, are indeed outmoded but these are just a small part of the curriculum. The subjects taught, algebra, Euclidean geometry, trigonometry, solid geometry, and, in many schools, analytic geometry, are still the basic subjects, basic from the standpoint of the logical structure of mathematics and basic from the standpoint of application to the sciences and engineering. The trouble with the present curriculum lies rather in the way in which we approach the material we teach. Mathematics is commonly presented as a series of techniques, processes, and theorems. There is no motivation for the

[3] A fuller account of the ideas of this committee will be found in Rosenbaum, E. P. "The Teaching of Elementary Mathematics," *Scientific American*, May 1958, pp. 64–73.

material; the subject is isolated from all other bodies of knowledge and human interests; and the knowledge acquired seems useless except perhaps to prepare a student to pursue more of this unattractive material.

If these are the difficulties the remedies are obvious. First of all we must take the time and the trouble to arouse interest in mathematics, to motivate the learning. Interest can be aroused by incidental as well as by significant themes. Games and puzzles may motivate some students. But motivation must not rely entirely on games or the student will get the wrong impression. Mathematics is not a series of games; if it were it would not warrant a place in the curriculum. True, a few students will respond to the sheer intellectual challenge if this subject is so presented. However solid motivation can be achieved by introducing simple, genuine and basic problems which can be formulated and solved mathematically and which, at the same time, lead to the concepts we wish to teach. In view of the intimate connection between mathematics and the physical sciences most of the problems will come from this area. However, music, art, biology, and the social sciences also provide good problems and each of these fields can be exploited to handle the problem of motivation.

Of course mathematics must not be submerged in a host of applications. To formulate a problem mathematically one must introduce mathematical concepts. To solve the problem one must learn and apply some techniques. Moreover, the mathematical methods of solution must be taught and distinguished from methods used in other sciences and fields of thought. Obviously mathematical methods are different and possess their own effectiveness else mathematics would not be the powerful subject it now is. Hence the nature, concepts, and role of mathematics would be the primary object of attention despite the use of physical and other problems to motivate the subject and to demonstrate the values of mathematics. Hence there should be no question that one is teaching mathematics and not physics or some other science.

It is important in talking about problems to distinguish the trivial from the fundamental. Many teachers have used problems drawn from carpentry, agriculture, tool and die making, machinery, weaving and the like. Such problems are neither basic nor broad enough in appeal; they may serve for vocational training but not for liberal education. On the other hand, problems involving straight line and projectile motion, astronomy, light, sound, electricity, and the elements of chemistry, and utilizing broad physical principles such as the Newtonian laws of motion or the law of gravitation are not only basic but involve familiar phenomena. Moreover, these physical topics do not require that much science be taught; the subject matter is partly familiar and intuitive. Further, the applications should even enlighten students about their world.

The suggestion that mathematics be tied in somewhat with science

seems radical but only to those who have lost sight of the primary reason for the existence and development of the subject. The various branches of mathematics were created to help man understand the physical world and, in more recent years, to harness the processes of nature in behalf of man's necessities, convenience, comfort, and health. The great mathematicians and the great scientists were the same people. Though space does not permit full documentation it may suffice to recall that the three greatest mathematicians of all time, by common consent, were Archimedes, Newton, and Gauss. The first two of these were also the greatest scientists of their eras and even Gauss made major contributions to astronomy, geodesy, electricity and magnetism, map-making, systems of insurance, and statistical studies of errors of measurement.

The need to arouse interest by introducing physical and other problems will necessitate some changes in at least the order of topics. At the present time the first year of algebra presents students with a series of techniques such as simplification of fractions, laws of exponents, factoring and the solution of first and second degree equations in one and two unknowns. These processes are not significant in themselves and can hardly be attractive to students. Hence it would be desirable to reorganize this first year's work especially, so as to permit the introduction of broader and yet technically simple themes and to introduce the algebraic processes only as needed in the solution of larger problems. The use of functions in the study of motion, light, and gravitation is a fine possibility for the larger theme. If some of the processes now taught should be delayed until a second year of algebra when the availability of geometry permits more varied investigations there will in the long run be no loss. Certainly if we take into account that the present second year of high school algebra must repeat almost all that is taught in the first year because the meaningless material does not stay with the student, and that the first year of college also repeats a great deal of high school work, then we can see that we shall not lose time but may gain it. Moreover, we now lose most of the students who take high school mathematics because they find no interest in the subject and see no point to studying it. Here, too, if we can attract more students, we shall gain.

In the geometry course also we must, while preserving the unavoidable logical order, introduce problems and applications which will show the importance of the subject. The student who is taught that the altitudes of a triangle meet in a point and says, "so what?" has raised a question which deserves an answer. We might hope that the beauty of the deductive structure of mathematics and the appeal of its convincing arguments would win students over at least in geometry where logical structure and reasoning are more readily presented. But the appeal of such

values is apparently not enough and even if it were would not do justice to the power and nature of mathematics.

The use of physical problems to arouse interest, to give meaning to the mathematics by enabling the student to see physically what his formulas and theorems are saying, and to show the accomplishments of mathematics is pedagogically wise. But there is a deeper reason for presenting mathematics in conjunction with other branches of knowledge while of course emphasizing the mathematics. Knowledge is a whole and mathematics is part of that whole. While a few individual mathematicians, having understood the point and purpose of mathematics and having acquired a love for it, may have been content to pursue their ideas without regard for application, the various branches of mathematics did not arise in that way nor would the subject be in demand if mathematics existed in and for itself. Mathematics in every age has been intimately involved in most of the broad intellectual and artistic movements. The separation of knowledge into history, science, mathematics, and so on is the artificial presentation and though necessary to some extent for pedagogical reasons should not be pursued to the detriment of learning. Indeed were mathematics an isolated discipline it would appeal only to esoterics and would warrant a no more important place in the high school curriculum than say music.

It seems to the writer that mathematics motivated by and applied to problems of many other fields of knowledge and human activity would be attractive to students. Such a presentation should meet the objectives of teaching the nature of mathematics, the power of deductive reasoning, the certitude gained by proof, the usefulness of mathematics in other domains of thought, and the disclosure of fields of study among which the high school student may ultimately choose a career.

While the writer has thought a good deal about the aproach to the mathematics curriculum which has just been sketched, has worked on it, and has discussed it with a number of college professors and high school teachers, it is true of this approach as of the others described above that a detailed curriculum is not available nor has experimentation on a large scale been attempted. Hence in this direction too no wide scale action is advisable at present.

Unsatisfactory as the situation in mathematics education may be today from the standpoints of attracting students and of effective pedagogy no road to improvement is now cleared. All one can do is watch the progress being made in the several directions being pursued.

ARITHMETIC AS A FIELD OF MATHEMATICS

BY ELVA ANDERSON,* HARRIET GRANT,† JOHN HANCOCK,‡ DOROTHE NELSON,§ AND MARIE RENAUD‖

In the American "ladder of education" the elementary and secondary programs developed independently, and their articulation has always been rather casual. Arithmetic is the primary responsibility of the elementary school, and what is done there has not been a major concern of secondary teachers. This is unfortunate, in view of the fact that, in several important areas, both levels are seeking the same outcomes. The secondary teachers depend for what they can do upon what has been started in arithmetic.

Among the widely divergent opinions as to the direction reforms in the secondary mathematics curriculum should take, for example, there is general acceptance of the importance of developing such abilities and understandings as the following:

Understanding of the fundamental laws of operations which underlie all manipulations of elementary algebra;

Understanding the primitive concept of number, as distinct from the symbolic expression;

Ability to use the concepts and principles of mathematics to explore a new situation and improvise new procedures for solving a problem;

Understanding the relationship of mathematics to the social and scientific aspects of the culture.

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It is interesting to find these also accepted as major outcomes in arithmetic. Apparently the secondary schools and elementary schools, in seeking the same outcomes independently, are each operating in ignorance of what the other is doing.

This fact is of special importance in view of the nature of the outcomes. Abstract understandings and concepts such as these are developed over a long period, from innumerable concrete experiences. What can be achieved in a year of algebra, by itself, for example, is sharply limited. But if a year of algebra is the culmination of a series of experiences running through the grades, the outcomes may be planned on a more ambitious basis. This articulation requires a common understanding of the elementary and secondary programs with mutually defined expectations and obligations for each level. As a step in that direction, it is proposed here to call attention to what is being done in the grades to achieve each of the above outcomes. The literature on arithmetic methods has been reviewed to find what is recommended, and recent texts have been examined to identify current practices. From this it is possible to describe, with reasonable confidence:

a. The typical activities, at various levels, directed to the outcome;
b. The level to which the understanding or ability is commonly developed; and
c. Some suggestions as to modifications in practice that might be useful to promote articulation of the secondary and elementary programs in achieving the outcome.

The Associative, Commutative, and Distributive Laws

The three basic laws of number, although applied by school children throughout the grades, are rarely formalized and consequently seldom thoroughly understood. Except where they have been carefully taught, they are not grasped even by high school graduates. The associative, commutative, and distributive laws in algebraic form, with arithmetic examples, are as follows:

Associative Law	*Algebraic Form*	*Arithmetic Example*
For addition	$a + (b+c) = (a+b) + c$	$3 + (5+8) = (3+5) + 8$
For multiplication	$a\,(bc) = (ab)\,c$	$2\,(3\times5) = (2\times3)\,5$
Commutative Law		
For addition	$a + b = b + a$	$6 + 9 = 9 + 6$
For multiplication	$ab = ba$	$7 \times 5 = 5 \times 7$
Distributive Law		
For multiplication	$a\,(b+c) = ab + ac$	$4 \times 27 = 4\,(20+7)$ $= (4\times20) + (4\times7)$
For division	$(a+b) \div c = \frac{a}{c} + \frac{b}{c}$	$168 \div 3 = \frac{150}{3} + \frac{18}{3}$

Although at first the laws may seem obvious, note that none of them applies to all four fundamental processes. Indeed some examination is necessary occasionally (i.e., the distributive law for division) to determine that the law really does hold. Even though a pupil realizes that

$$3 + 4 = 4 + 3,$$

what happens to him when he first encounters a $+ \frac{}{b}$ or a $- \frac{}{b}$? Unless he has a clear understanding of the law, his first intuitive guess may be that the first is equal to b + a (true) and that the second is equal to b − a (untrue).

As Boyer points out: "If we should now plan to venture into an application of mathematics to fields we cannot connect with our experience, it is obvious that we must plan to pay greatly increased attention to the fundamental laws of operations. For in the correct application of these laws, and in this only, can we find confidence that the conclusions we establish will be valid."[1]

Applications of the laws are encountered in the early grades. The pupil is taught explicitly, with concrete examples, that $5 + 2$ and $2 + 5$ are both equal to 7. He learns that in multiplication either factor may be used as the multiplier. This fact facilitates multiplication, since $\begin{matrix}189\\ \times 3\end{matrix}$ is simpler than $\begin{matrix}\times 3\\ 189\end{matrix}$. The distributive law is applied in multiplying 8×29: $(8 \times 9) + (8 \times 20) = 72 + 160$.

In division, the dividend is broken up into appropriate addends, each of which is divisible by the divisor:

$$168 \div 3 = (150 \div 3) + (18 \div 3).$$

Observe how this comes about in the algorism:

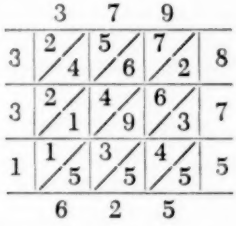
$$\begin{array}{r} 56 \\ 3\overline{)\,168} \\ \underline{15} \\ 18 \\ \underline{18} \end{array}$$

While applications of the laws are found in grade-school textbooks, they are never explicitly formalized. Even methods books on the teaching of arithmetic and on the teaching of secondary school mathematics, are remarkably devoid of direct attention to these laws. Spencer and Brydegaard generalize the commutative law for addition: "The order of

[1] Boyer, L. E. *An Introduction to Mathematics for Teachers.* H. Holt & Co., 1945. p. 158.

the addends may be changed without changing the value of the sum."[2] This is accompanied by examples. Note, however, that they do not *name* the laws even in a book for teachers. Marks, Purdy, and Kinney[3] go further in naming the laws and giving examples.

Since the applications have been developed intuitively before grade seven, the laws could profitably be formalized by the end of the eighth grade. Such formalization would consist in recapitulating examples to show what each law is and how it has been used. The pupil would learn why the associative and commutative laws are applicable in multiplication and addition, but not in division or subtraction. He knows this intuitively; it is time to make it explicit. He should be able to explain how the distributive law operates in multi-place multiplication and long division. It could be extended to devising procedures for multiplication with Roman numerals, and to explaining the rationals for the "lattice" algorism for 379×875:



If the fundamental laws have been learned as they apply in the fundamental operations of arithmetic, their applications can readily be generalized in algebra. If not, it is doubtful if a year is sufficient time to accomplish this outcome. Algebra should be a generalization of what has been previously learned in arithmetic.

Primitive Ideas of Number, as Distinct from Symbols for Number

Some recommendations[4] for content in ninth-grade algebra place considerable importance on learning the differences between number and the symbolism of number. While this is an important distinction, the possibility should be considered that continued re-emphasis on these differences in the later grades would make further teaching at the secondary level unnecessary.

Every child comes to school with some concepts of number. He may

[2] P. L. Spencer, and M. Brydegaard. *Building Mathematical Concepts in the Elementary School*, H. Holt & Co. 1952. p. 120.

[3] J. L. Marks, C. R. Purdy, and L. B. Kinney. *Teaching Arithmetic for Understanding*, McGraw-Hill, 1958. p. 153, 187, 215.

[4] University of Illinois, Committee on School Mathematics, "Algebra for Grade Nine," Urbana, Illinois, 1955.

not grasp the idea of a year of time as such, but certainly when he learns to count out as many fingers as candles, as an answer to the oft-repeated question, "How many years old are you?" or "How old are you?" he is beginning to develop the concept of number.

An inspection of methods books in the teaching of arithmetic shows that they stress in varying degrees the development of the primitive idea of number before the pupil learns to use the symbols. The purpose of this distinction is to make the symbols a tool for use in thinking and in problem-solving, avoiding the verbalism that results from premature use of the symbol before the concept is developed. Combinations of groups, place value, and grouping to ten and one hundred, are developed first through concrete materials, then tallies, and finally symbols. By the third grade, according to some authors, children should be using symbols in handling money values, telling time by clock and calendar, and counting by groups of two, ten, five, and three.[5]

Clark and Eads[6] devote the entire first chapter to progressing from "things to concepts." These authors begin with experiences, progress beyond experiences to having ideas about arithmetic, then to expressing arithmetical relationships concretely through handling representative materials, thence to seeing mathematical relationships, and finally to symbolic representation of concepts.

These procedures are recommended also in teachers' manuals for the newer elementary arithmetic texts.[7,8,9] They carefully point out the development of concepts of number and how the teacher may best accomplish it in using the books.

After the early years, however, this distinction tends to be lost. Introduction of Roman numerals in grade four or grade five could well afford another opportunity to distinguish between the number and the symbol, since the pupil now sees the same number represented by two different symbols. If, in grades seven and eight, the pupils studied number systems with bases other than ten, the meaning of numbers, as well as of place-value, might be strengthened to the point where little re-emphasis on the distinction of number and symbol in grade nine would be necessary.

Developing Concepts and Principles through Analysis and Exploration

The ability to analyze a new situation and symbolize existing relationships in order to improvise a tentative solution is fundamental to success

[5] J. Marks, C. Purdy, L. Kinney, *op. cit.*

[6] Clark and Eads, *Guiding Arithmetic Learning*, World Book Company, New York, 1954.

[7] *Discovering Numbers*, John C. Winston Co., 1957. (California State Series).

[8] McSwain, Ulrich, Cooke, *Understanding Arithmetic*, Laidlaw, Palo Alto, 1956.

[9] Buswell, Brownell, Sauble, *Arithmetic We Need*, Ginn and Co., 1955.

in algebra. What is frequently overlooked by secondary teachers is that this is an ability toward which "meaningful" procedures in arithmetic are directed. In learning new concepts in the grades, pupils are encouraged to explore and test new ideas that might lead them to discovery and generalization. In this the teacher is concerned with achieving two outcomes: (a) teaching the pupil the rationale of the concept or process; and (b) teaching the pupil the general method of discovering a tentative generalization, and testing its validity, that is typical of mathematical reasoning.

The "meaningful teaching" of arithmetic, which is basic to the procedures encouraged in all modern arithmetic texts, emphasizes the utilization of such reasoning and understanding in the early grades.

> "The goal in all meaningful learning is for the pupil to organize what he learns from specific experiences into broader, more generally applicable principles. . . . Such principles, developed progressively from active and concrete experiences in increasingly complex arithmetic situations, tend to organize and systematize learning."[10]

Consider an example of how a third-grade teacher introduces multiplication by four. It is near Valentine's Day. The teacher suggests they have a post office in the corner of the room so they can post their valentines. The pupils choose a postmaster, who must deal with the selling of four-cent stamps. It may be hard for him at first to figure out how much three four-cent stamps will cost. The class helps him find the answer, probably in several different ways including counting and addition.

A variety of situations are provided for, each calling for the same process, such as having the pupils arrange strips of colored paper in groups of four. The teacher may ask, "How many strips of paper do you have?" The students will probably count them. She then asks how many there are in one group, and writes on the blackboard $1 \times 4 = 4$. She then does this for two groups: $2 \times 4 = 8$. After experiences with these and other concrete materials for exploration and improvising, the pupils are ready to generalize and discover the more economical process of multiplication.

The teacher will then show them how this new process saves time in selling four-cent stamps. Putting on the board $1 \times 4 = 4$, $2 \times 4 = 8$, and $3 \times 4 = 12$, she will ask the students to generalize: $4 \times 4 =$ what? Many of the students will follow the line of logical reasoning and be ready to answer. The teacher will ask $5 \times 4 = ?$ She can have them make another group to prove the validity of the generalization. In this way the use and value of the multiplication tables are "discovered" and the pupils proceed to master the combinations for use in practical situations.

[10] J. L. Marks, C. Purdy, and L. B. Kinney, *op. cit.*, p. 26

This detailed description illustrates at an elementary level the general approach used in the grades. In learning a new process the pupils are expected to explore, improvise, and discover the relationship underlying the operation. It takes longer than demonstration and explanation, it will often be trial and error, but each pupil becomes an active participant in the learning process. Generalizations or rules thus appear late in the instructional process, for they are an end rather than a beginning. The pupil gains his rules as generalizations resulting from experimentation, rather than words to be learned and applied by rote.

This elementary type of exploration, generalization and validation is carried through the multiplication process and into division. It is not emphasized, as it might be, however, in grades seven and eight. The secondary program would be strengthened if the "meaningful" approach were extended at this more mature level to the process of problem solving.

While there are innumerable problems, there is only a limited number of types of problems as defined by the relationship between the elements in the problem. Many problem situations, such as a trip in a plane, a car, a boat, hiking, bicycle riding, or a foot race, afford examples of travel at a constant speed for a specified time. Once the pupil has sensed the similarity of the problem and ignores the extraneous details, he sees the common elements of d, r, and t with their constant relationships. This similarity can be high-lighted in the *post-solution analysis*. Thus consider the problem:

> A plane is traveling 350 miles an hour. How long will it take to travel from San Francisco to New York if the distance is 2800 miles?

Once the problem has been solved, the numbers can be changed, and attention directed toward the procedure for solving the problem. The next step is to substitute letters for numbers:

> If a plane is traveling r miles per hour, what is the time required to travel the distance d miles?

Handling the relationships as letters rather than as numbers focuses attention on the elements common to all problems of this type.

Once the relationships between time, rate, and distance have been recognized, they can be applied to a variety of similar situations. The same relationship is valid whether for rowboat or rocket. Eventually, when the pupil expresses the relationship as a formula, $d = rt$, he has a compact and meaningful tool which applies to an identifiable type of problem situation.

Continued experience in post-solution analysis leads to still broader generalizations in identifying types of problems:

The total cost c = number of items n $\times$ cost of each item p.

This same relationship applies also to the total amount earned, given a number of hours and wages per hour; the total number of gallons of gasoline consumed by a plane given the number of hours traveled and the number of gallons consumed per hour; and so on.

As experiences with these relationships accumulate, the pupil eventually generalizes that in each case one number is the product of two others, and that one formula, $A = BC$, expresses the relationship common to all.

Such a logical and systematic study of arithmetic can lead the pupils to look for common relationships, to state the relationship as a general principle, then verify and refine the principle. This is a mature method of thinking on which a more effective secondary program could be built.

Mathematics in its Social Setting

Arithmetic is an essential part of the everyday life of every pupil. Throughout the grades this everyday setting is continually utilized. We have seen how in teaching the multiplication tables, for example, the process is introduced to the pupil in a situation that is familiar to him, in buying stamps at four cents each. After he has systematically mastered the process, he must learn to recognize situations that call for multiplication. These are also found in his everyday experience and the experience gives him practice not only in applying the process he has learned, but also in recognizing situations that call for multiplication as distinct from addition.

The problem setting, then, should serve two purposes: to illustrate the type of situation to which the process (in this case, multiplication) applies; and to provide opportunity to study the important applications of arithmetic in the environment. For most pupils, this is to be accomplished in the grades, since there is no further study of arithmetic after grade eight.

To a limited extent, arithmetic can be used to broaden the experiences of the pupil. Applications new to him can be made interesting and meaningful through special procedures. The bulletin board can be of material assistance in this stage, with contributions both from the teacher and from the pupils. Many successful teachers make this a central part of the class activity under direction of a designated committee. Films, film strips, and resource persons are also utilized with good effect, when the planning is carefully done, to make problem situations real.

The older textbooks included extended treatment of interest, insurance, investments, property taxes, and installment buying. It was discovered, however, that there is a limit to the extent that problem situations outside the pupil's experiences can become meaningful. It is doubtful if these important applications can be made sufficiently meaningful to be profitably studied by a fourteen-year-old pupil. A junior or senior in high school will be in a group where buying a car, for example, will make many of

these problems significant. The present secondary curriculum is not organized, however, so that study of these topics can parallel the experiences of the pupil. While a few schools have a twelfth-grade mathematics course that includes these topics, such courses are an exception rather than the rule.

If we are serious in maintaining that mathematics is to be imbedded in the scientific and social structure of our environment, it is important that this neglected area be recognized as such and taken into account as the secondary curriculum is revised. This will come about only when the problems studied in the curriculum can be related to the everyday experiences of the pupil.

SUMMARY

From these illustrations the following conclusions may reasonably be drawn:

1. The elementary and secondary schools are working independently toward common outcomes, each of which requires joint planning to secure sequential treatment.
2. Some outcomes (such as primitive concepts of number as distinct from symbolization) could probably be achieved in the elementary school.
3. Others (as social applications) cannot be completed in the elementary school, but require systematic attention at the secondary level as well.
4. Others are so comprehensive and important that they call for joint planning, and a clear understanding as to the desired level to be reached in the elementary school. This is true of the fundamental laws, and ability to explore and generalize. Here it is necessary for grades seven and eight to assume new and important responsibilities in the teaching of mathematics.

It is clear that an effective program will not be possible, either in elementary arithmetic or secondary mathematics, until an articulated program has been planned for grades one through twelve. Mathematics is a highly sequential field. It cannot be effectively taught unless each teacher can build on what the pupil has learned, and knows what the next teacher is doing. Only when program articulation has reached this stage of development, can important outcomes such as those discussed here be adequately achieved.

NEW HORIZONS IN PREPARATION OF MATHEMATICS TEACHERS

BY MARY K. TULOCK*

Modern Demands on Mathematics Teachers

Not long ago the primary demand on the teacher of mathematics was to present content that was well defined and generally accepted. It is evident that this is no longer the case, and the factors that have modified the situation are too well known and publicized to need repetition. They have, however, focused increased attention on the importance of the program in mathematics, as well as on new and broader obligations of the mathematics teacher. Since the implications for the preparation of mathematics teachers have not been widely recognized, it is worthwhile to examine some emerging responsibilities of the mathematics teacher before turning to the desirable program of preparation.

1. *To keep up with new industrial developments*: A major industrial leader, writing of his experiences in the birth and growth of the electronics industry on the West coast, points out that most of the work in which his industry is engaged today deals with ideas, products, and services that were not known or even thought of before the war. If our educational program produces people competent to take advantage of the tremendous opportunities, industry is on the threshold of even greater horizons. The issue is clearly defined so far as the secondary school teachers are concerned. Do the teachers take the dramatic changes in environment for granted, or do they recognize the responsibilities they entail? Can they keep abreast of the whirlpool of surrounding forces? Do they know what it takes to cope with modern life in this technological age?

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2. *To keep up with modern mathematical theories*: Modern mathematics has contributed in a major way to the dramatic changes around us. In order to make this contribution a "modern mathematics" has developed to the point where, according to one school of thought, our secondary mathematics curriculum is obsolete. Recognition of these newer concepts is required in planning a modern secondary school mathematics program. Only those who have recently been prepared for a teaching career have had any opportunity to take the modern content courses, and in only a few of the collegiate institutions are such courses available.

3. *To provide leadership in curriculum construction*: It is an accepted fact that secondary school mathematics programs need extensive and careful revision. But without careful establishment of desired goals, and without continuous evaluation, we are in danger of leaping on our horses and galloping off in every direction. To a casual reader the many proposals for revision of the mathematics curriculum must appear confusing and contradictory. The staff needs leadership from the mathematics teacher in interpreting these proposals, appraising them, and selecting the recommendations suitable for the local school system.

4. *To locate, serve, and develop our manpower resources.* If an able youngster, capable of becoming a scientist or an engineer, misses out on the secondary mathematics courses essential for college entrance, he has eliminated himself from a career that may be important both to himself and to society. Elimination of this sort is too frequent and serious for us to view with equanimity. It is not enough to have suitable courses and good mathematics instruction. Excellent guidance is necessary for us to profit from them.

Too often this guidance is viewed as a responsibility of the counseling program rather than of the mathematics teacher. When we become aware of the fact, however, that typically, for the country as a whole, there is one counselor for more than twelve hundred students, it is evident that an effective guidance program requires the services of the classroom teacher. Not only must the mathematics teacher take the lead in planning a program that will provide for the slow, average, and superior student; he must also know how to identify the aptitudes of each student, help him to set realistic goals for himself, and guide him into the courses where he can achieve his maximum potential.

These newly emerging responsibilities present two major problems in the preparation of mathematics teachers, which should be separately considered. Obviously, the pre-service programs of teacher preparation must be broadened in accordance with modern demands.

Beyond this, however, teachers now in the program need to be brought up-to-date with respect to mathematics content and modern applications

of mathematics. In addition, their broad responsibilities for leadership in program building and counseling represent aspects of the program of preparation which, in many instances, were neglected at the time when they received their preparation.

How to set up these in-service programs and pre-service programs is a curriculum problem for which the college and local school administration are professionally responsible. The purpose here is to consider in detail some of the results to be obtained, and to suggest only in general some of the more promising means by which such results may be accomplished.

The Pre-service Program of Preparation

The urgent need for teachers capable of modernizing the secondary school mathematics curriculum requires careful consideration in planning a pre-service program of preparation for mathematics teachers.

Even from the brief analysis above, it becomes evident that the development of a program for preparation of mathematics teachers adequate to meet modern demands requires the cooperation of all departments in the college that are concerned with general education, mathematical competences, and professional education. The closest cooperation of the mathematics department is required to plan the subject matter content in mathematics that will both familiarize the student with the "modern" mathematics and with the modern applications of mathematics. An understanding of mathematics in our culture, which can be communicated to the secondary student, calls for a well designed general education program. And the leadership roles of the mathematics teacher in curriculum development and counseling call for professional preparation with clearly designed purposes, probably developed from experiences rather than from highly theoretical courses. The over-all program must accordingly be designed to provide competence in two general areas.

First is effective instruction and counseling, based on a scholarly background in mathematics. Teaching skills, however important, cannot substitute for a sound knowledge of content. It is frequently emphasized by writers in this field that mathematics developed in our culture as a result of the needs created in our social and physical environment, and that it is to be presented to pupils in this same setting. Certainly the mathematics teacher today needs to know enough about the modern mathematical theories and applications to judge how much of this material can and should be presented in the secondary school, and to lead the pupil to appreciate its importance.

At the same time, the teacher must be familiar with the significance of mathematics both for the technical leader and for the general citizen.

He must know enough about current technological developments to assume effectively the leadership in counseling that our new technological culture requires of him. What new career opportunities are developing? Why does the average citizen need mathematics today? What mathematical factors have helped revolutionize our civilization? What part will mathematics probably play in the development of our society? How have other disciplines been affected by mathematics? What will be the effect of mathematics on world peace, world economy, and the newly developed nations?

A second area of competence is effective preparation for staff membership. Leadership requirements in curriculum development, evaluation, and counseling call for more effective programs in the professional aspects of teacher preparation. The majority of current experimental programs in teacher preparation do not reflect this new requirement, but are rather a negative reaction in response to the criticisms of the theoretical nature of professional courses. While an increased emphasis on classroom participation is commendable, there is little evidence, in the reported experiments, of clearly defined objectives and careful evaluation that would show the way to more effective program building. When they have clearly defined goals and are properly evaluated, experimental programs may be so designed as to point the way to a more effective preparation of teachers in less time than is now required.

Programs for In-Service Education

Every teacher, no matter how well prepared, needs a systematically planned program of in-service education to keep abreast of the changing and increasing demands of the school. This need is not unique to teachers. It is said that over 85 per cent of the medicine prescribed nowadays by physicians was unknown fifteen years ago. Changes in architecture, engineering, and other professions place similar demands on the practitioner for directed study of recent developments.

The most widely publicized of the current programs for secondary mathematics teachers are those designed to give the teachers a chance to get caught up on modern mathematics and its applications. During the past year the National Science Foundation gave 1,700 high school mathematics teachers a chance to widen their horizons on the campuses of various colleges. The Shell Foundation provides a summer program at each of two universities, one in the East, the other in the West, for the same purpose. All such programs should be evaluated in terms of the changes brought about in the local programs, rather than in the individual teachers. No matter how much a teacher may learn about mathematics and its modern applications, if these learnings are not reflected in local leadership

in program development and counseling as well as in instructional effectiveness, they are only partially adequate. In the last analysis it is the responsibility of the local administrator to articulate the local program development with these opportunities for further study. The mathematics teacher who is selected for one of these fellowships should have clearly in mind his local responsibilities for program leadership in planning his program of study. When he returns to his community his responsibilities for increased leadership should be clearly defined. The extent to which he meets his responsibilities will serve as a measure of the effectiveness of the in-service program of preparation.

These programs, and others of similar nature, have been of inestimable value in revealing the value of continued study, and the kind of program that is most useful. It is still the local system, however, that must carry the major responsibility for seeing that the teachers are kept up-to-date. A number of school systems have taken the initiative in showing the way, with procedures following these general lines: bringing the mathematics teachers together on a program to update the curriculum and improve teaching skills; organizing study groups, with the help of a nearby college or consultants; sending teachers to summer institutes; and collecting a good reference library. The responsibility for leadership falls on the administrator. The objective of the project is program improvement through improved staff effectiveness.

The Need for a More Fundamental Attack

It is clearly apparent that even the most ambitious of the proposals and current operations can be nothing more than a temporary stopgap. What is to be gained, for example, in flooding schools and colleges with increasing numbers of students through scholarships, loans, work-study help and other means if we have not enough qualified teachers to teach them? If there is not enough money to employ qualified teachers now, how can we handle the desired increase in recruited technical leaders? The statistics make it quite clear that the number and per cent of mathematics teachers who are being prepared decreases from year to year. In competition with industry we are losing a critical battle. Any proposal to correct this by giving increased salaries only to teachers in critical areas is of questionable value. We need a balanced school program and cooperation among staff members based on a recognition of equality in importance among various school disciplines. The problem can be solved only when competent teachers are recognized and rewarded in accordance with their social contribution. The key to building an effective program lies in recognizing that teachers and industrial leaders are of equal value in our society.

PROGRAM EVALUATION IN MATHEMATICS

BY LUCIEN B. KINNEY*

In the published discussions of mathematics in the secondary schools the trend is away from hysterical criticism, in the direction of constructive and serious study. This is evident not only in publications by individuals[1] but by professional organizations as well. Among the manifestoes published by national organizations this year, the following are noteworthy:

The National Council of Teachers of Mathematics, *As We See It*;

Commission on Mathematics of the College Entrance Examination Board, *Modernizing the Mathematics Curriculum*;

U.S. Office of Education, *Guidelines for Science and Mathematics*;

National Association of Secondary School Principals, *The Place of Science and Mathematics in the Comprehensive Secondary School Program*.

The urgent need for an improved mathematics program is reflected in the financial support now becoming available for experimentation. In addition to funds currently made available by Congress, are such foundation-supported projects as the University of Illinois Committee on School Mathematics, the University of Maryland Study of Junior High School Mathematics; the Commission on Mathematics of the College Entrance Examination Board; and the School Mathematics Study Group, initiated last summer at Yale.

A number of states and larger cities are actively engaged in program

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[1] See, for example, the paper by Morris Kline in this issue and E. P. Rosenbaum, "The Teaching of Elementary Mathematics," *Scientific American*, 198: 64–73, May, 1958.

study and revision in mathematics, and are publishing recommended curriculums and other useful material in the field. The Texas Education Agency, for example, has recently issued a bulletin entitled *The School Superintendent and the Mathematics Program*, reflecting the concern of the administrator for this critical area.

While these broad recommendations and projects are most stimulating and enlightening, they will touch only a fraction of the schools and mathematics teachers in the country. Without the cooperation and support of the local school systems they will be relatively futile. It is still the responsibility of the local administration and staff, in mathematics as in all fields, to select the best of the recommendations of authoritative groups, and to adapt them to the local situation. Program building is inherently a local responsibility. In any locality it must be based on an evaluation of the strengths, weaknesses, and needs of that locality. The facts needed for an adequate diagnosis will become available only through an "agonizing reappraisal" of its own program by the school staff, under competent administrative leadership.

An evaluation carried out for this purpose today calls for a broader operation than in the past, when evaluation in mathematics was concerned primarily with methods of teaching. Until recently, while there was some suggestion for removing "deadwood" from the curriculum, it was assumed that the question of what to teach was not a major issue.

Today the validity of the mathematics curriculum is being challenged on a variety of grounds. The local staff and administration are called on to select intelligently among conflicting proposals on the basis of local requirements, and to measure the effectiveness of revisions in producing carefully formulated outcomes. Such questions as these need to be answered:

1. Are program objectives being defined in light of current mathematical requirements in the student body? Is the staff informed, for example, as to new opportunities in industry and the mathematical requirements of the careers being created?
2. Are the courses in the curriculum effectively designed to achieve the objectives for which they are intended?
3. Are the students for whom the courses were intended actually being guided into the courses?
4. Are studies and activities being carried on to articulate the secondary program in mathematics with those preceding it in the grades and those following it in the college?

It is clear that questions such as these call for an evaluation not only of the mathematics curriculum, but of the entire school organization. They

can be answered only if administrative leadership is available to coordinate the efforts of the entire staff. It is no longer a question of whether or not mathematics is being taught effectively. The question is whether the school is making the contribution to manpower that is critically needed in our society. It will be useful to examine here some aspects of the school program that need careful evaluation, not only to determine where revision is needed, but also to measure the effectiveness of such revisions as have been made.

Evaluating the Curriculum

Two major aspects merit attention of the staff in evaluating the mathematics curriculum as such. These are the definition of desired outcomes, and the content and organization of the courses.

The Aims.[2] There is never any scarcity of aims in mathematics. They can readily be found, many of them expressed in "large and beautiful words" as Polya puts it. The question is whether they are suitable for their purposes. If so, they will be adequate to orient curricular development, and to serve as a basis for evaluation of the program. For these purposes they must satisfy the test of three major criteria: feasibility, social validity, and objectivity.

Aims are said to be feasible if they can be achieved through a reasonable expenditure of time and effort. This is a familiar criterion, and historically it is about the only one that has been utilized in mathematics. It was on this basis that the decision was made, late in the nineteenth century, that first algebra and then geometry should be moved down from the college into the high school curriculum. No consideration was given to the fact that at the college level geometry had been taught to students who had a background in philosophy, and that high school students without this background might possibly fail to appreciate the beauty and rigor of the Euclidian proof. Since this criterion lends itself to research designs that appear eminently respectable, many of today's researchers are following along this historical pattern.

Because a subject *can* be taught in the high school, however, it does not necessarily follow that it *should* be taught there. The personal and social values of the competence must also be established. Kline, in another paper in this *Journal*, questions some of the present-day recommendations on this basis. The same questions might be raised about many of the programs now provided for the gifted pupil.

What is being overlooked is the second criterion, that of *social validity*. This criterion may be stated as a question: Is the outcome socially impor-

[2] A more detailed and technical discussion of this general question will be found in: Lucien Kinney, "Criteria for Aims in Mathematics," *The Mathematics Teacher*, XLI (March 1945), 99–103.

tant? To answer this question we need definite information on the needs of society and also on the ability, interests, and plans of the pupils in the student body. Usually it is possible to identify three major groups. One group includes those pupils who will not be likely to enter a vocation with any specific mathematical requirements beyond everyday adult usage. A second is a college-bound group who needs mathematics primarily to meet college requirements. The third group includes potential leaders in technical and scientific fields, calling for a rigorous program of mathematical preparation.

Whether there are mathematical outcomes to be achieved beyond preparation for adult activities depends on the social philosophy of the staff. Even if our outlook is limited to a utilitarian view of adult activities, however, we need more information before we can define specific goals. We do not have information as to the nature of the requirements or the minimum levels of achievement for these mathematical requirements, to serve as a basis for establishing curricular standards for any one group. There is, of course, a considerable amount of information of this sort available from researches already carried out. However, much that has found its way into bibliographies is of little or no value because of obsolescence, the inadequacy of the research design, or the carelessness with which inferences have been drawn.

The third main criterion in evaluating aims is *objectivity*. Will two competent observers agree as to whether a given pupil has achieved the stated outcome?

Frequently the aims as stated in the literature are more useful as poetic expressions of admiration for the field than as definitions of desired outcomes. Both for purposes of curriculum building and evaluation, desired outcomes are practically useful only when stated as a description of pupil behavior. A rigorous test for objectivity is to ask: Can one recognize the competence in a pupil who has achieved it, and differentiate him from one who has not? Application of this criterion to the so-called "intangible" outcomes, such as appreciation, attitudes, and interests, has a particularly important effect in clarifying our thinking as to the kinds of behavior we are seeking, the situations in which that behavior should be manifested, and the classroom experiences that might be expected to produce such behavior.

Evaluating the Curricular Content.—Two questions are important in evaluating the course content. Is the content logically related to the desired outcomes? and, to what extent are these outcomes being achieved? If the stated aims are functional in orienting curriculum development, the relationship between the aims and course content should be apparent. This can be tested for each "track" or specialized curriculum, including that for the gifted:

Are any of the desired outcomes not provided for in the curriculum? Is any of the course content irrelevant to the objectives?

This is a rigorous test, especially necessary in mathematics courses. In well-established fields, such as demonstrative geometry for example, a "functional autonomy" is likely to develop, with the subject becoming its own justification. In the crowded high school curriculum of today this situation is no longer permissible. Even the most respected fields must have a demonstrable reason for existence.

The final test of curricular validity, of course, lies in the evidence that each course is fulfilling its purposes. An evaluation program is adequate only if it extends to all major outcomes, including those which cannot be effectively measured by tests. If such outcomes as understanding, appreciation, and interest are not regularly appraised, the mathematics curriculum can readily deteriorate into computational manipulations and solution of artificial problems. It is axiomatic that an outcome not regularly evaluated is not being achieved.

The Mathematics Curriculum in Relation to the All-School Program

Mathematics is not effectively learned as an isolated and esoteric field. Historically it was developed as a necessity in studying the social and physical environment, and it is to be learned in the same way. This point of view is important in evaluating not only the curriculum itself, but also its relationship to the rest of the school program. It shows up clearly in two crucial aspects: counseling, and the articulation of the secondary mathematics program with those that precede it and follow it.

Counseling. The responsibility of the staff has not ended when suitable courses have been designed for well-defined groups of students. The students actually enrolled in the courses must be those who can profit from them. The extent to which this is true is a measure of effectiveness of the counseling program of the school.

The importance of counseling in the multi-purpose high school has been highlighted by Conant, who proposes that the administrator should present an accounting of the program taken by each of the identifiable groups of students:

> What per cent of the superior group took four years of mathematics? What per cent of each of the other groups was provided with the mathematics that they will require?

Such questions as these test the effectiveness of counseling procedures in matching pupil aptitudes and needs with appropriate courses in mathematics. It is not merely a question of assigning pupils to classes. The decision of each pupil is influenced by his interests and the wishes of his parents, and should be guided by the recommendation of the eighth-grade

teacher. The important question is whether all who have a part in this choice have up-to-date information on careers and the mathematical requirements of each career.

The kind of coordination required to get each pupil into the right "track" is illustrated in the operations in the Los Altos (California) School District. In January and February the eighth-grade pupils in the district come to the high school to take an intelligence test and an algebra aptitude test. The scores of each pupil on these tests, along with his achievement in eighth-grade arithmetic and the eighth-grade teacher's recommendation as to the "track" in ninth-grade mathematics he should select, are reported to the parent.

In March there is a general meeting of parents and high school staff, at which the significance of the test scores is explained to the parents in relation to the high school program. Each parent gets a schedule of ninth-grade classes to take home, and is asked to prepare a program for the pupil. In April the high school counselors go out to the grade schools and spend some time with each eighth-grade pupil, going over the proposed program, and adjusting it as seems desirable.

The effectiveness of any such program can readily be measured by the proportion of pupils who are eventually found in courses suited to their ability and interests.

Inadequate counseling in mathematics at the end of the eighth grade is probably the most serious bottleneck in our preparation of leaders for science and technology. Failure to take high school courses in science, while deplorable, can readily be corrected in college. But the student going into a technical program in college needs four years of high school mathematics. If he fails to take freshman algebra, he has several unattractive choices: to double up on mathematics courses or to take non-credit work in college. Any one of these alternatives may be sufficiently unattractive to discourage a student from pursuing a technical career. Avoiding them is primarily the responsibility of the eighth-grade teacher.

This is not to say that a pupil should be asked in the eighth grade to make a permanent commitment as to his career. Interests do, and should, change. Yet investigations reveal that pupils entering the high school have, in the majority, made definite though tentative choices as to the careers they intend to pursue. Under present conditions it is desirable that those who have the interest and ability to go into technical and scientific fields should take algebra and geometry early enough to maintain their freedom of choice later on.

Articulation. Mathematics is a highly sequential subject. The principles, generalizations, and abstractions of mathematics are continuously developed and refined through experiences that must be carefully articulated from year to year. At two points those responsible for the secondary

mathematics curriculum face major problems in providing this continuity: at the ninth grade with the grades, and at the twelfth grade with the college. The key questions are: What activities are being carried on by the staff in articulating this program with those that precede and follow it, and how effective are they?

Some of the procedures necessary for articulating the programs of grade and high school mathematics are considered elsewhere in this issue of the *Journal*. On the basis of considerations outlined there, as well as the need for effective guidance in grades seven and eight, several of the projects for subsidizing the in-service improvement of mathematics teachers are including teachers from grades seven and eight.

The problem of articulating the high school and college programs is even more complex. One might expect to find a well-established point for terminating high school instruction and beginning the college program. On the contrary, an initial and somewhat superficial investigation of college programs in mathematics indicates that while some college freshmen are starting with college algebra, others are starting analytic geometry, while still others are bypassing much of analytic geometry and starting with the calculus. This presents an individual responsibility to each high school staff to explore the programs in the colleges commonly accepting the students from that high school. Articulation can be considered satisfactory only when the high school and college staffs have arrived at a mutually agreeable understanding as to the minimum terminal point in secondary mathematics.

The Broadened Responsibility of the Secondary School

The responsibility for guiding prospective leaders in science and technology into carefully designed mathematics courses is only one aspect of a new and critical responsibility of the entire secondary school staff: the discovery and conservation of human resources. The shortage of technical leaders can not be viewed as an isolated phenomenon. There is also a shortage of physicians, business executives, elementary teachers, and many other non-technical personnel requiring college preparation. We can no longer afford to pursue a laissez-faire policy. Available statistics do not support the view that leadership talent will reveal itself, and choose the most suitable preparation.

To assure that a suitable program is available and is selected by the pupil, however, requires an extended program of curriculum building, counseling, and evaluation involving the entire staff. Unless every teacher has preparation and time for this job, it will not be done. It must be explicitly accepted by the secondary school as a new major responsibility. Our greatest resources are human resources; our richest resources are human resources fully developed.

ENROLLMENT—

More pupils and more problems is the forecast for 1958–59, when the nation's schools reopen for the new school year this week and next. According to the United States Office of Education, about 45,000,000 students are expected to attend schools and colleges, a gain of over 1,500,000 since last year.

The increased enrollment, a result of the rising birth rate and the desire of more Americans to improve their status, will be felt all along the line, from kindergarten through college. The elementary schools are expected to jump from 30,670,000 last year to 31,793,000 this year; secondary schools, from 8,434,000 last year to 8,800,000; and colleges and universities, from 3,450,000 last year to 3,623,000.

The mounting enrollment and other conditions will create a shortage this year of 132,000 qualified teachers. This, United States Education Commissioner Lawrence G. Derthick said, "will be met by a return to teaching by former teachers, by the employment of emergency teachers and, in part, by too-large classes."

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